Online ISSN : 2249-4626
Print ISSN : 0975-5896
DOI : 10.17406/GJSFR

Global Journal

of Science Frontier Research: D

Agriculture & Veterinary

Merino Wool Fiber

Mass Insemination Technique

Highlights

Small-Scale Dairy Farming

Lymphocyte-Monocytic Blood Link

Discovering Thoughts, Inventing Future

VOLUME 21 ISSUE 4 VERSION 1.0

Global Journal of Science Frontier Research: D
Agriculture & Veterinary

Global Journal of Science Frontier Research: D
Agriculture & Veterinary

Volume 21 Issue 4 (Ver. 1.0)

Open Association of Research Society

Incorporation No.: 0423089
License No.: 42125/022010/1186
Registration No.: 430374
Import-Export Code: 1109007027
Employer Identification Number (EIN):
USA Tax ID: 98-0673427

Global Journals Inc.

*(A Delaware USA Incorporation with "Good Standing"; **Reg. Number: 0423089**)*
Sponsors: Open Association of Research Society
Open Scientific Standards

Publisher's Headquarters office

Global Journals® Headquarters
945th Concord Streets,
Framingham Massachusetts Pin: 01701,
United States of America
USA Toll Free: +001-888-839-7392
USA Toll Free Fax: +001-888-839-7392

Offset Typesetting

Global Journals Incorporated
2nd, Lansdowne, Lansdowne Rd., Croydon-Surrey,
Pin: CR9 2ER, United Kingdom

Packaging & Continental Dispatching

Global Journals Pvt Ltd
E-3130 Sudama Nagar, Near Gopur Square,
Indore, M.P., Pin:452009, India

Find a correspondence nodal officer near you

To find nodal officer of your country, please email us at *local@globaljournals.org*

eContacts

Press Inquiries: *press@globaljournals.org*
Investor Inquiries: *investors@globaljournals.org*
Technical Support: *technology@globaljournals.org*
Media & Releases: *media@globaljournals.org*

Pricing (Excluding Air Parcel Charges):

Yearly Subscription (Personal & Institutional)
250 USD (B/W) & 350 USD (Color)

Editorial Board

Global Journal of Science Frontier Research

Contents of the Issue

Global Journal of Science Frontier Research: D
Agriculture and Veterinary
Volume 21 Issue 4 Version 1.0 Year 2021
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Herbáceas Ruderales Urbanas Con Potencial Tintóreo Sobre Fibra Lana Merino. Caso de estudio en la ciudad de Comodoro Rivadavia, Chubut, Argentina

By Silvia González, Amanda Cordero, Laura Castro & Mabel Segovia

Resume- The knowledge of the dyeing species of the Patagonian steppe and the incessant development of the dyeing textile artisanal activity, motivated us to investigate the dyeing potential on merino wool of the ruderal plants of the city. While they are disposable in public spaces and undesirable in private parks and gardens, they are an unlimited material resource for natural dyes. Material was collected from urban and periurban areas. Using the mother recipe, the dye was obtained and three etching treatments were developed. Hue, luminosity and saturation were studied. 19 species were processed, obtaining the colors with the highest saturation in the post-etching process. The outstanding species are *Chenopodium album* L. and *Dysphania ambrosioides* (L.) Mosyakin & Clemants of the Chenopodiaceae family. Of the species studied, part of them have never been registered in the bibliography in use for this purpose. We consider knowledge of this resource of great value to enhance its use and preserve the native Patagonian floristic diversity.

Keywords: *merino wool, ruderal plants, adventitious plants, patagonia, dyeing potential, natural dyes, applied ecology, economic botany.*

GJSFR-D Classification: *FOR Code: 079999*

Strictly as per the compliance and regulations of:

Herbáceas Ruderales Urbanas Con Potencial Tintóreo Sobre Fibra Lana Merino. Caso de estudio en la ciudad de Comodoro Rivadavia, Chubut, Argentina

Silvia González [α], Amanda Cordero [σ], Laura Castro [ρ] & Mabel Segovia [ω]

Resumen- El conocimiento de las especies tintóreas de la estepa patagónica y el incesante desarrollo de la actividad artesanal textil tintorera, motivó a investigar el potencial tintóreo sobre lana merino de las plantas ruderales de la ciudad. Mientras son desechables en espacios públicos e indeseables en parques y jardines privados, son un recurso ilimitado de material para los tintes naturales. Se recolectó material en áreas urbanas y periurbanas. Mediante la receta madre se obtuvo el tinte y se desarrollaron tres tratamientos de mordentado. Se estudió tono, luminosidad y saturación. Se procesaron 19 especies, obteniendo los colores de mayor saturación en proceso post-mordentado. Las especies destacadas son *Chenopodium album* L. y *Dysphania ambrosioides* (L.) Mosyakin & Clemants de la familia Chenopodiaceae. De las especies estudiadas, parte de ellas nunca han sido registradas en la bibliografía en uso para tal fin. Consideramos de gran valor el conocimiento de este recurso para potenciar su uso y preservar la diversidad florística autóctona patagónica.

Palabras clave: lana merino, plantas ruderales, plantas adventicias, patagonia, potencial tintóreo, tintes naturales, ecología aplicada, botánica económica.

Resume- The knowledge of the dyeing species of the Patagonian steppe and the incessant development of the dyeing textile artisanal activity, motivated us to investigate the dyeing potential on merino wool of the ruderal plants of the city. While they are disposable in public spaces and undesirable in private parks and gardens, they are an unlimited material resource for natural dyes. Material was collected from urban and periurban areas. Using the mother recipe, the dye was obtained and three etching treatments were developed. Hue, luminosity and saturation were studied. 19 species were processed, obtaining the colors with the highest saturation in the post-etching process. The outstanding species are *Chenopodium album* L. and *Dysphania ambrosioides* (L.) Mosyakin & Clemants of the Chenopodiaceae family. Of the species studied, part of them have never been registered in the bibliography in use for this purpose. We consider knowledge of this resource of great value to enhance its use and preserve the native Patagonian floristic diversity.

Keywords: merino wool, ruderal plants, adventitious plants, patagonia, dyeing potential, natural dyes, applied ecology, economic botany.

Author α: Investigadora independiente. Independent researcher Av. Armada Argentina 2526. Rada Tilly. 9001. Chubut. Argentina. e-mail: silvit2526@gmail.com
Author σ ρ ω: artesanas textiles.

I. Introducción

Los tintes y colorantes naturales son una parte esencial del patrimonio ecológico y cultural del mundo; su selección y usos para crear colores son comunes a todas las civilizaciones. El repentino resurgimiento del interés por los tintes y colorantes naturales con fines económicos, no sólo para textiles teñidos, notablemente también para su uso en cosméticos, tintes para el cabello y colorantes alimentarios, se pudo observar en los últimos años (Cardon, 2010; Burgess, 2011; Pochettino, 2015). Si no se abordan adecuadamente todas las implicaciones ambientales por falta de compartir y discutir el conocimiento relevante, un desarrollo repentino impulsado por el consumidor de los usos de tintes naturales a escala industrial masiva, podrían conducir paradójicamente, entre otras consecuencias, a saqueo catastrófico de las últimas estaciones de algunas fuentes de tintes amenazadas en algunos países y finalmente a la extinción del recurso (Marzocca, 1959; Cardon, 2010). Vastas campañas de investigación, de prospección y evaluación de los potenciales colorantes de las plantas de diferentes entornos naturales ciertamente también podría revelar una gran cantidad de colorantes "nuevos", no utilizados tradicionalmente (Cannon & Cannon, 2003; Cardon 2010; Callahan, 2010; Dean, 2010; González *et al.* 2020). Hasta fines del siglo pasado, antes del desarrollo de la industria de los tintes químicos, el uso de colorantes naturales era tan necesario que las especies tintóreas se cultivaban a gran escala y constituían una importante fuente de ingresos para los países productores. En cambio, en la actualidad, estas plantas se encuentran sólo en estado silvestre. Ello es una razón más para que actuemos siempre con el mayor respeto a la naturaleza, limitando la recolección a la cantidad que realmente se vaya a necesitar. (Roquero & Córdoba, 1981). En la búsqueda de alternativas se vuelven las miradas hacia aquellas técnicas tradicionales basadas en un conocimiento profundo de los ciclos de la naturaleza a la que utilizan sin degradarla (Stamigioli, 2007). Las materias primas naturales colorantes o tintóreas, no obstante, la dominante difusión de los colorantes artificiales o

industriales de síntesis siguen interesando a muchos usuarios quienes emplean aún en muy diversos menesteres. Es por ello que los vegetales que poseen pigmentos útiles tanto nativos de nuestro país Argentina, como los exóticos adventicios o cultivados, merecen rescatarse del olvido en unos casos, o que se remueve la divulgación de su potencial valor, en otros, cuando su empleo como colorantes tintóreos es poco menos que desconocidos entre nosotros (Marzocca, A. 2009). Las plantas ruderales son especies sinantrópicas que prosperan en sitios asociados con asentamientos humanos, pueden ser huertos y jardines, lotes baldíos, basureros, escombros, grietas de los muros, tejados, ruinas, o bien, ocupan las orillas de vías de comunicación como caminos, carreteras de la zona urbana, vías de ferrocarril (Martinez-De la Cruz *et al.* 2015). Dentro de las plantas ruderales, las calificadas como malezas presentan un rol controvertido en asociación con las actividades del ser humano, mayormente son especies in deseadas, aunque en ciertas coyunturas son toleradas y esporádicamente ensalzadas por sus capacidades biológicas de vida y colonización (Arroyo, 2019). Estas capacidades biológicas provocan que dispongamos de ellas en cantidades considerables y necesarias para conformar nuestro posible Material Vegetal Tintóreo (González *et al* 2020). Desde ahora en adelante nos referiremos al Material Vegetal Tintóreo con las siglas MVT. Diversos estudios en América han investigado la composición florística de las especies ruderales, en el caso de México, De la Cruz *et al.* (2015) estudia las plantas ruderales del área urbana de Malinalco y encuentra dentro de un gran listado de especies, a *Polygonum aviculare* L. (Sanguinaria) y *Taraxacum officinale* F.H. Wigg. (Diente de león). En Chile Gartner *et al*. (2015) trabajaron con la caracterización de la diversidad, composición y distribución de especies ruderales nativas e introducidas presentes en diferentes comunas de la ciudad de Santiago de Chile. Se encontró que los ensambles de especies ruderales están dominados por la presencia de especies introducidas. Los resultados indican además que la distribución espacial de malezas en la ciudad de Santiago no es aleatoria, pues dos conglomerados fueron encontrados en función de los patrones de similitud composicional. Probablemente obedecen a un complejo de factores entre los que se pueden mencionar el modo de uso de suelo, y/o programas de ornamentación del paisaje urbano. Las especies *Chenopodium album* L., *Convolvulus arvensis* L., *Dysphania ambrosioides* (L.) Mosyakin & Clemants, *Hirschfeldia incana* (L.) Lagr. -Foss., *Malva parviflora* L., *Polygonum aviculare* L y *Taraxacum officinale* F.H.Wigg. forman parte del listado de especies ruderales, que coincidentemente se encuentran también distribuidas en nuestra área de trabajo. En Mendoza, Mendez (2005), estudió la flora y vegetación del centro urbano de Luján de Cuyo. Dando a conocer dentro de un amplio listado, varios géneros, que son parte de nuestro interés como MVT para la ciudad de Comodoro Rivadavia. Las epecies *Chenopodium album* L., *Convolvulus arvensis* L., *Dysphania ambrosioides* (L.) Mosyakin & Clemants, *Hirschfeldia incana* (L.) Lagr. -Foss., *Polygonum aviculare* L y *Taraxacum officinale* F. H. Wigg. se encuentran en el listado de especies ruderales, también encontradas en el trabajo de Gartner et al. (2015) para CHile. Rapaport & Marzocca (2009), describen las malezas comestibles, orígenes, propiedades y sus usos, dentro de un gran listado, se incorporan a las siguientes especies: *Anthemis coluta* L (Manzanilla cimarrona), *Atriplex semibaccata* R. Br. (Sarbuchi), *Lepidium draba* L. (Wency), *Chenopodium album* L. (Quinoa), *Dysphania ambrosioides* (L.) Mosyakin & Clemants (Paico), *Cichorium intybus* L (Achicoria), *Erodium cicutarium* (L.) L'Hér. ex Aiton (Alfilerillo), *Marrubium vulgare* L. (Malvarrubia) y *Plantago lanceolata* L. (Siete venas), pero no hacen referencia a su utilización como MVT. En el caso de Arroyo (2019), describe los efectos negativos de las malezas para la Región Semi árida Central de Argentina entre ellas: *Chenopodium album* L., *Dysphania pumilio* (R. Br.) Mosyakin & Clemants, *Erodium cicutarium* (L.) L'Her. ex Ait., *Hirschfeldia in-cana* (L.) LagrFoss., *Lepidium draba* L., *Marrubium vulgare* L., *Taraxacum of-ficinale* G.H. Weber ex Wiggers, *Rumex crispus* L., *Salsola kali* L., los géneros enunciados corresponden entre otras a algunas de las especies que son objeto de nuestro trabajo de investigación. En la Provincia del Chubut, Forcone (2009) describe a *Erodium cicutarium*, (Alfilerillo) como frecuentes en las terrazas y faldeos del valle inferior del Río Chubut y Arce & González (2000), la describen dentro de la flora del distrito del Golfo San Jorge y Kröpfly Villasuso (2012), como integrante de la flora de los pastizales del monte oriental de la Patagonia. También Forcone (2009) incorpora a Cichorium intybus (Achicoria), *Lepidium draba* L (Wency), *Polygonum aviculare* L (Sanguinaria) y *Taraxacum officinale* F.H.Wigg (Diente de león), dentro de las plantas frecuentes en los bordes de canales del Río Chubut. Quintana (2015) describe a *Convolvulus arvensis* (Correhuela) como ruderal en zona este nordeste de la Patagonia, a *Plantago lanceolata* (Siete venas) en bordes de caminos, a *Erodium cicutarium* (Alfilerillo) en baldíos y suelos modificados, *Atriplex semibaccata* (Sarbuchi), *Salsola kali* (Cardo ruso), *Anthemis coluta* (Manzanilla cimarrona), *Marrubium vulgare* (Malvarubia) y *Lepidium draba* (Wency), como especies adventicias naturalizadas para la misma zona. Para la ciudad de Comodoro Rivadavia específicamente no existe un trabajo previo de la diversidad florística urbana ruderal sobre el cual basar nuestra investigación. Por ello, damos el marco teórico de estudios similares realizados para las regiones de Cuyo y de Patagonia. Desde el estudio del atributo tintóreo, en Uruguay, de la Bandera (2002) trabajó con *Plantago*

lanceolata (Siete venas) y *Taraxacum officinale* (Diente de león), en Bolivia, Arias Rocha (2018) trabajó con *Chenopodium album* (Quinoa) y en Colombia Corradine Mora (2014) también trabajó con *Rumex crispus* (Lengua de vaca) y *Anthemis coluta* (Manzanilla cimarrona) obteniendo en todos los casos distintas gamas de colores amarillos. Para Argentina, Marzocca (2009), nombra a *Medicago sativa* (Alfalfa), *Erodium cicutarium* (Alfilerillo), *Rumex crispus* (Lengua de vaca), *Chenopodium album* (Quinoa) y *Dysphania ambrosioides* (Paico) con sus cualidades tintóreas. Las distintas técnicas que se utilizan para la extracción de los tintes naturales vegetales son: maceración, el machacado, la disolución en agua o diversos solventes, separación por decantación, desecación entre otras (Stramigioli, 2004; Marzocca, 2005; Marrone, 2010; Milía, 2011, González et al. 2020), en el 100% de los tratamientos realizados en nuestra investigación se procedió a la maceración por 24 h. El presente trabajo estudia el potencial tintóreo sobre fibra lana merino de las plantas herbáceas ruderales urbanas de la ciudad de Comodoro Rivadavia, motivadas a explorar posibles recursos vegetales tintóreos, de crecimiento rápido, fácil recolección y disponibles en grandes cantidades, dada por capacidades biológicas de vida y colonización que presentan estas especies (Arroyo, 2019). Prima el propósito de preservar las especies autóctonas y endémicas del patrimonio natural patagónico como poner a disposición el conocimiento de una lista de especies encontradas en nuestras areas de circulación cotidiana que poseen la capacidad de brindar una amplia gama de colores y no se han dado a conocer aún.

II. Materiales Y Métodos

a) Área de estudio

El trabajo se desarrolló en la cuidad de Comodoro Rivadavia, ubicada en el extremo sureste de la Provincia de Chubut. La ciudad de Comodoro Rivadavia fue fundada el 23 de febrero de 1901, su ubicación cardinal es 45°52'00"S y 67°30'00"O, cuenta con una población total según los datos oficiales de la ciudad de 227.875 habitantes (Sitio web oficial www.comodoro.gov.ar) (Fig. 1). El petróleo es su principal actividad económica y sus yacimientos de explotación abastecen un importante porcentaje del consumo nacional. El clima de la ciudad de Comodoro Rivadavia se enmarca en el árido patagónico, con precipitaciones anuales normales escasas, el viento predominante es del cuadrante oeste con una velocidad media de 42 km/h con ráfagas violentas y persistentes. En lo que respecta a las precipitaciones son escasas durante todo el año, sobre todo en verano. Las temperaturas son variantes, pero bien definidas en el año se aprecian inviernos frescos y lluviosos y un verano seco y cálido. La ciudad de Comodoro Rivadavia tiene uno de los ejidos urbanos más grandes de la Patagonia donde se alternan lomas, depresiones, cañadones, accidentes costeros, cerros y lagunas. Las zonas urbanas, incluyendo calles y rutas, suman 2.572 hectáreas. El suelo de la ciudad está condicionado por las instalaciones petroleras y perforaciones, siendo la misma el eje económico petrolero de la cuenca del Golfo San Jorge.

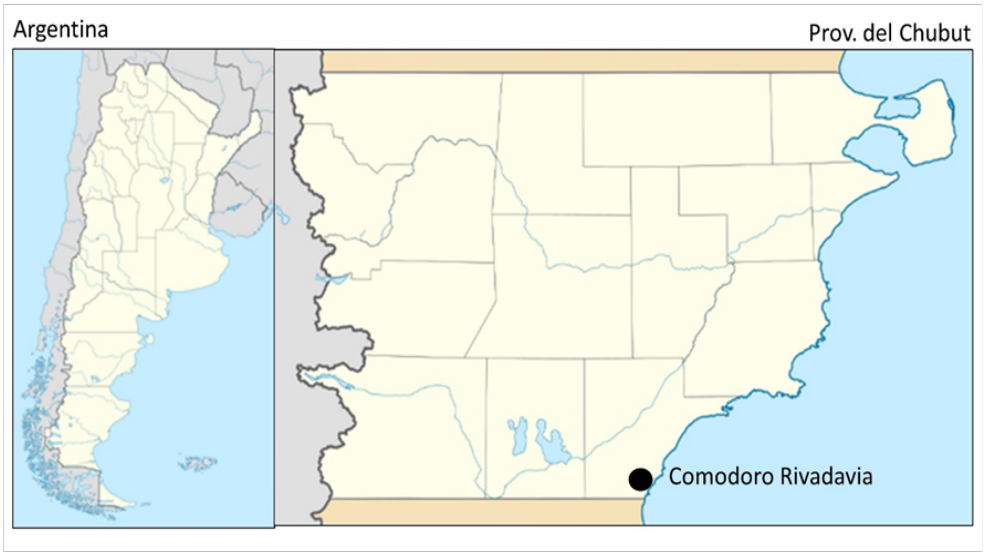

Fig. 1: Mapa de Argentina y ubicación de la ciudad dentro de la Prov. Del Chubut

Los sitios de recolección del MVT se distribuyeron en distintas áreas urbanas como veredas, boulevares, parques y plazas descuidadas, sitios baldíos, banquinas de caminos sin pavimento y periurbanas, terrenos de cañadones y mesetas circundantes a la ciudad.

b) Recolección del MVT

Durante los años 2018 y 2019, entre los meses comprendidos en las estaciones primavera y verano se realizaron las recolecciones del MVT. Se consideraron las especies cosmopolitas de crecimiento espontáneo en sitios urbanos como veredas, boulevares, espacios abiertos, baldíos, banquinas de caminos comunicantes sin pavimento y peri urbanos como áreas de terrazas y terraplenes dejados por la actividad petrolera de los cañadones y mesetas circundantes a la ciudad. El MVT que se empleó consistió en planta completa o bien ramas y hojas en el caso de especies con mayor dificultad para su extracción. Las especies recolectadas se determinaron, se compararon con las del Herbario Regional Patagónico y los nombres científicos de cada una fueron corroborados con la versión on-line del Catálogo de las Plantas Vasculares del Cono Sur (Zuloaga *et al*., 2017) y consultas de bibliografía (Correa, 1998; Arce & González, 2000; Forcone, 2009, Quintana, 2015). Se recolectaron 300 gr. de MVT para cada tipo de tratamiento, pre-mordentado, mordentado directo y post-mordentado. (Marrone, 2010; Milia, 2011, González *et al.* 2020) Se realizó un registro fotográfico de cada especie en particular, aspecto general, flor y fruto, los distintos procesos de la metodología de trabajo y las madejas de lana coloreadas.

Extracción del colorante, tinción y ensayo de distintas técnicas de fijado Para todo el proceso de preparación del tinte y aplicación de la tintura se empleó la siguiente receta madre: 300 gr de material vegetal, 4 l agua, 20 gr alumbre, 100 gr lana merino, se utilizó como modificadores de color 15 gr bicarbonato de sodio y 5 gr sulfato de hierro. (González *et al.* 2020, Stamigioli, 2004; Marrone, 2010; Milia, 2011). En conjunto con tres artesanas calificadas, se procedió a teñir lana de oveja con el tinte obtenido de cada especie siguiendo tres procesos diferentes: 1) pre-mordentado, 2) mordentado directo y 2) post-mordentado siguiendo lo propuesto por Cardon (2007), Marrone (2010), Albán-Castillo *et al.* (2018), Portillo *et al.* (2019), González *et al.* (2020). Finalmente, se armó un muestrario de colores de acuerdo a los procesos y sus modificadores. Preparación del material y obtención del tinte. Se procedió a limpiar el MVT de posibles detritos y de restos de sustrato y se colocó en una olla de aluminio grande de 10 l de capacidad con 4 l de agua fría. A ese preparado se lo dejó macerando durante 24 horas, finalizando este tiempo se tiene la tintura lista para usar.

Preparación de la lana y teñido (González et al. 2020)

1. Pre-mordentado: para preparar la fibra a teñir, se remojó una madeja (de unos 100 gr) en un volumen de agua suficiente como para cubrir la fibra y 20 gr de alumbre. Se calentó el preparado hasta alcanzar los 80°C observando mantener esa temperatura durante unos 45´. Luego se retiró la olla del fuego, se dejó enfriar y se escurrió la madeja. Una vez que la lana dejó de gotear, se colocó en el tinte y nuevamente se llevó al fuego hasta alcanzar una temperature de 80°C, manteniendo el calor durante una hora.
2. Mordentado directo: al seguir esta técnica el alumbre se colocó directamente en el tinte, el resto de los pasos fueron iguales a los observados en el pre-mordentado.
3. Post-mordentado: en esta técnica de tinción agregamos al preparado el alumbre una vez que la fibra de la madeja está teñida. A continuación, se emplearon dos modificadores de color, bicarbonato de sodio y sulfato de hierro. Los mismos, se utilizaron durante el proceso de teñido: a la mezcla de tintura y lana se agregaron los 15 gr de bicarbonato de sodio y se dejó reposar unos 45´, se retiró la madeja del preparado, se agregó a la tinta 5 gr de sulfato de hierro, se mezcló bien y se volvió a incorporar la lana a la mezcla durante los 15´ finales hasta cumplir el tiempo de 1 h *Definición de color* Siguiendo la metodología detallada de Albán-Castillo et al. (2018) y González *et al.* (2020), *se definieron los colores mediante el* uso de la tabla de suelos "Soil-Color Charts" (Color, 2009). Cada color responde a la notación del sistema de Munsell (Color, 2009), el cual contempla un código de tres partes: color, luminosidad y saturación. Así definimos un color con la siguiente notación: Amarillo 2,5 Y 7/8

III. Resultados

Se recolectó MVT de 19 especies ruderales de crecimiento anual en áreas urbanas y peri urbanas de la ciudad de Comodoro Rivadavia, comprendidas en 11 familias taxonómicas (Tabla 1). En la totalidad de colores, de acuerdo a los diversos procesos, se obtuvo la siguiente proporción: 51% Amarillo, 30% marrón, 13% oliva, 3% verde, 2% gris y 1% rosado. (Fig. 2).

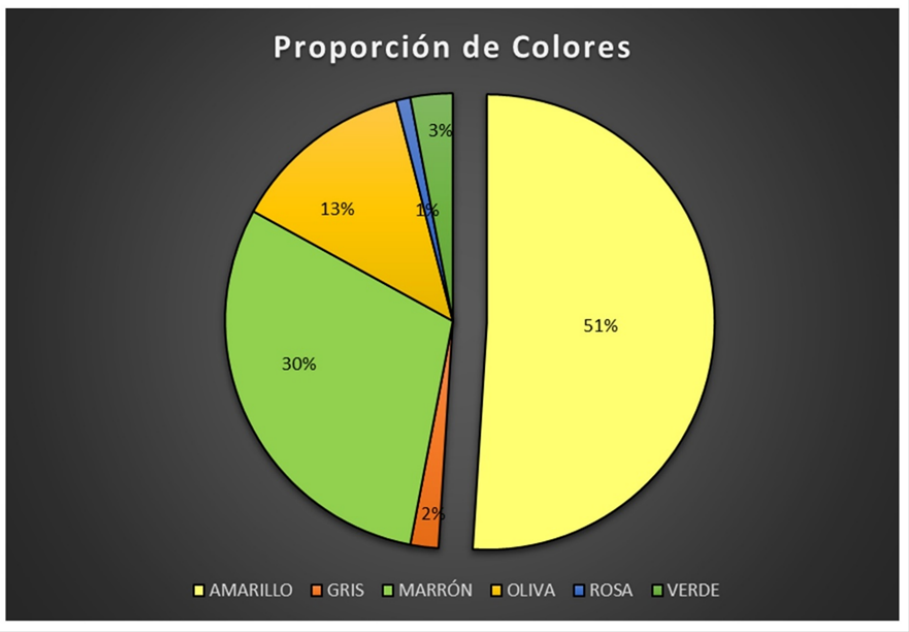

Fig. 2: Proporción de colores obtenidos en la totalidad de los procesos

Se destacan 14 especies con mayor saturación cromática. Los colores con mayor saturación se obtienen durante el proceso post-mordentado. La familia major representada es Chenopodiaceae con los géneros *Chenopodium album* y Dysphania *ambrosioides.*

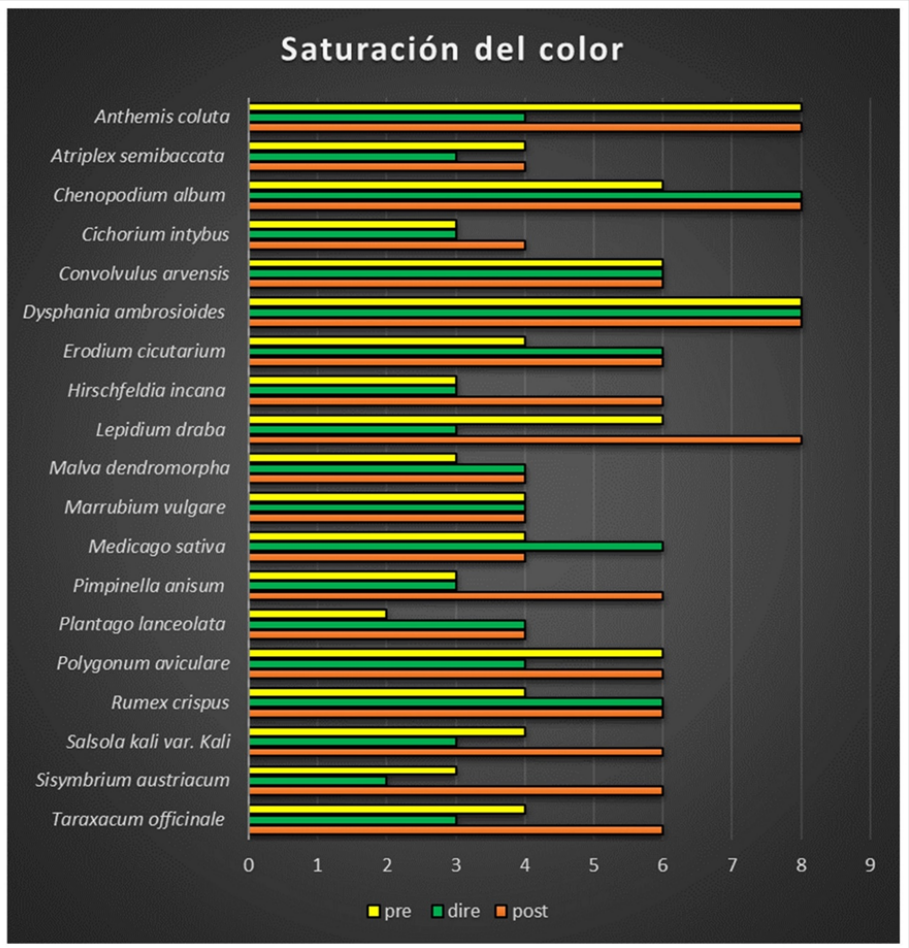

Fig. 3: Especies con mayor saturación cromática con valores 6 y 8

Los colores resultantes de cada proceso se muestran en la Tabla 1.

Tratamiento con Alumbre

Del análisis de la saturación del color en las fórmulas cromáticas, tomándose rangos altos de 8 y 6 de saturación, durante el proceso post-mordentado, se puede visualizar que el 68,5 % de las especies tienen buena respuesta a la capacidad tintórea. Las especies en cuestión son las siguientes: *Anthemis coluta, Chenopodium album, Convolvulus arvensis, Dysphania ambrosioides, Erodium cicutarium, Hirschfeldia incana, Lepidium draba, Medicago sativa, Pimpinella anisum, Polygonum aviculare, Rumex crispus, Taraxacum oficinale, Salsola kali var. kali y Sisymbrium austriacum*

En cuanto al predominio cromático, se puede destacar que durante el proceso post-mordentado, el color amarillo es dominante en un 58% de las especies (Fig. 4). En el proceso pre-mordentado el color predominante es el marrón pálido con un 32% de las especies (Fig. 5) y en el proceso mordentado directo la paleta de colores es más reducida y limitada a los siguientes colores: amarillo, amarillo pálido, marrón amarillento claro y marrón pálido (Fig. 6)

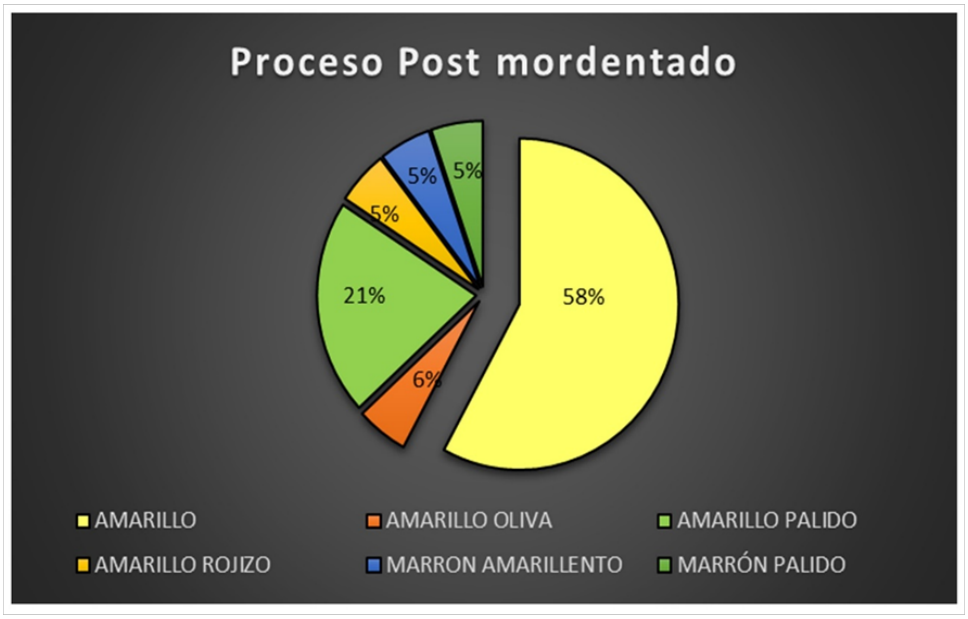

Fig. 4: Gráfico de predominio de colores en proceso post-mordentado

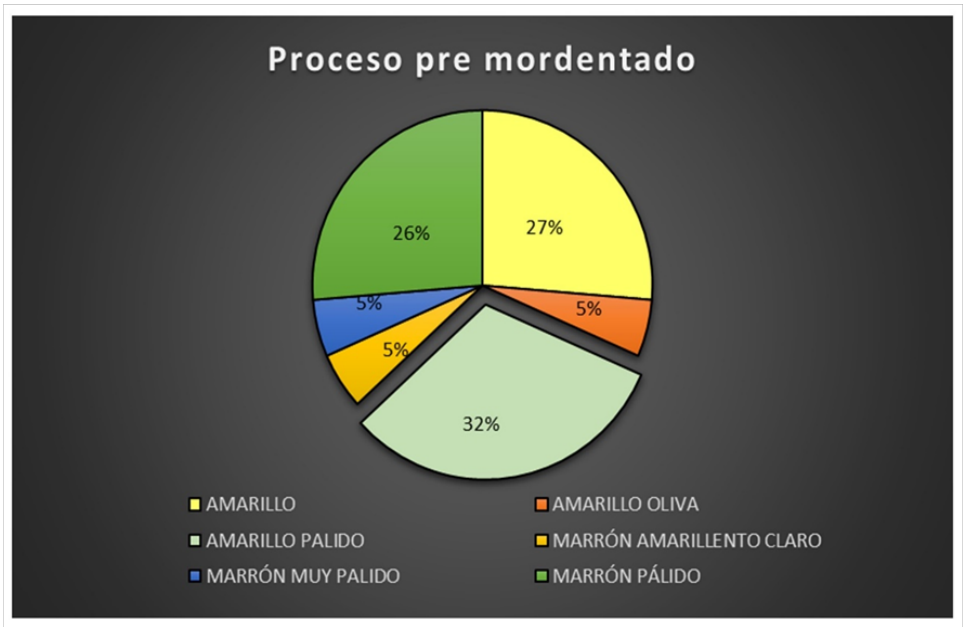

Fig. 5: Gráfico de predominio de colores en proceso pre mordentado

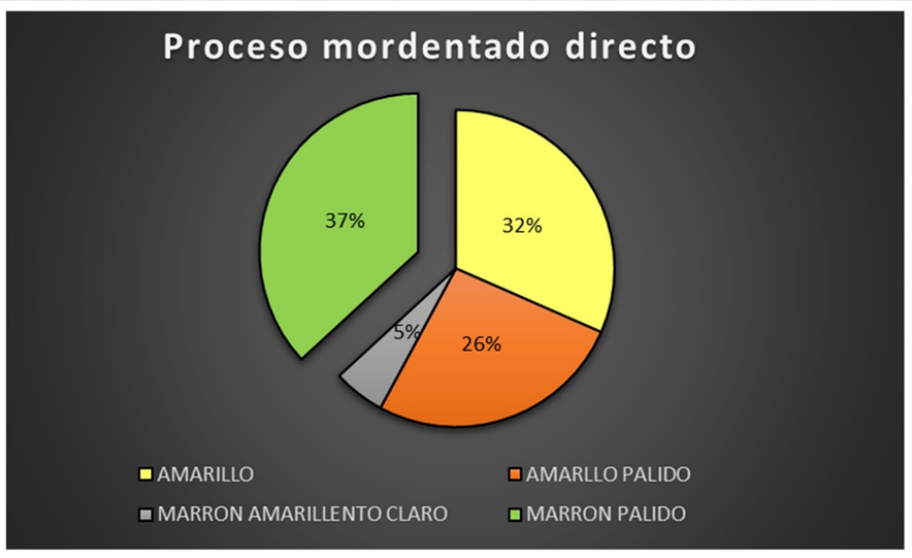

Fig. 6: Gráfico de paleta de colores reducida

Tratamiento con modificador bicarbonato de sodio (Tabla 1).

Se analizó la variabilidad en la saturación cromática comparando los colores con ambos tratamientos. Podemos afirmar que el 58% de las especies intensifica su saturación con el uso del modificador bicarbonato de sodio en el proceso mordentado directo, en el proceso pre-mordentado han variado un 37% de las especies, mientras que en el proceso post-mordentado es casi nula su variabilidad, representada por el 2 %. Las especies ruderales de *Dysphania ambrosioides, Chenopodium album y Anthemis coluta,* se manifiestan con homogeneidad en el color al uso del modificador y presentan las saturaciones más elevadas de color. Se observan en la figura 3 y se destacan con la referencia # en la tabla N° 1, como especies con excelente potencial tintóreo.

Tratamiento con modificador sulfato de hierro (Tabla 1)

El uso del modificador sulfato de hierro generó una gama de colores muy amplia dentro de los siguientes colores: amarillo oliva, marrón, marrón muy pálido, marrón oliva claro, oliva, oliva- grisáceo, oliva grisáceo oscuro, oliva-pálido, verde grisáceo claro y verde grisáceo oscuro.

En el proceso post-mordentado se obtienen los tonos de máxima saturación, por lo tanto, se sugiere el uso del modificador sulfato de hierro mediante dicho proceso. En las figuras 7-15, se pueden observar los colores de las especies sugeridas y destacadas en este trabajo con potencial tintóreo obtenidos sobre fibra de lana merino.

IV. Discusion Y Conclusiones

Del total de 171 resultados de los procesos de tinción obtenidos, mediante el tratamiento del MVT de 19 especies que constituyen la diversidad florística de las hierbas ruderales de la ciudad de Comodoro Rivadavia surge lo siguiente: *Anthemis coluta* L. (Manzanilla cimarrona) es una especie destacada, en nuestra experiencia el color que brinda es amarillo intenso, utilizando las ramas y hojas sin mezclar con otras especies. De acuerdo a Marzocca (2009), en Santiago del Estero y Catamarca han logrado colores semejantes empleando alumbre como mordiente. Roquero & Córdoba (1981), han trabajado con *Anthemis tinctorea,* en España obteniendo color amarillo brillante de sus flores y si deseaban lograr color kaki empleaban como modificador ácido acético. Cannon & Cannon (2003) también trabajaron con *A. tinctorea,* y registraron colores amarillos con alumbre semejantes a los de *A. coluta* y modificaron con Cromo y Cobre ampliando la gama cromática. Claramente el género es prometedor por sus cualidades tintóreas. *Medicago sativa* L. (Alfalfa) en nuestra investigación ha expresado mayor intensidad de color mediante el proceso mordentado directo y la tonalidad es amarillo. Es importante saber que el empleo de esta especie no requiere pre-mordentado afirma Marzocca, A. (2009) su utilización en tintes naturales, es coincidente con nuestros resultados. Otra especie con potencialidad es *Erodium cicutarium* (Alfilerillo), si bien no tiene máxima saturación, alcanza una intensidad considerable durante el proceso mordentado directo. Marzocca, A. (2009) afirma su utilización en tintes naturales coloreando de amarillo. *Marrubium vulgare* L. (Malva rubia) si bien no se destacó en nuestra investigación, la cual brindó marrón pálido durante los tres procesos de mordentado, es nombrada por Marzocca (2009) donde afirma el potencial tintóreo de sus flores y también los tallos. En el caso de Rumex crispus L. (Lengua de vaca), los colores más destacados fueron en mordentado directo y post y los colores fueron

amarillos. Según Dominguez y colaboradores las raíces contienen tanino y un colorante amarillo. Martinez Crovetto, los cazadores recolectores de Chubut usaban las raíces y teñían lanas de ese color. Lo expresa en su libro Marzocca (2009). Burgess (2011) también empleó esta especie, pero a diferencia de nuestra experiencia y la expresada por Martinez Crovetto, utilizó la raíz para dar color rosa suave. En Colombia, esta especie es citada para obtener colores amarillos, usaron las hojas y no emplearon mordientes Corradine Mora (2014). Dean (1999), trabajó con esta especie y obtuvo una amplia paleta de colores, de las hojas logró tonos de amarillos y verdes mientras que de las hojas obtuvo una gama de marrones y rojizos. *Polygonum aviculare* L. (Sanguinaria), según Marzocca (2009) las hojas de esta hierba brindan una sustancia colorante azul utilizada en China para teñir seda. En nuestra experiencia, es una de las especies destacadas por la intensidad de su saturación amarilla. *Chenopodium album* L. (Quinoa), especie que en procesos de mordentado directo y pre mordentado han brindado amarillo intenso, sin embargo, Marzocca (2009) afirma que las hojas se usaban en Hungría para teñir los cueros de color rojo. *Dysphania ambrosioides* (L.) Mosyakin & Clemants (Paico), según publica Marzocca (2009), que el professor Ortiz Garmendia afirma que Reszczuski realizó ensayos con partes aéreas obteniendo tintes amarillo canario en seda y amarillo limón en hilo y algodón, mostaza en lana, tonos que se tornaban más vivas con el uso de amoníaco enfrío. En nuestra experiencia el amarillo que brindó es muy intenso, es la especie que mantuvo la misma saturación durante los tres procesos y que bajo la aplicación del modificador de color también mantuvo su saturación. *Taraxacum officinale* F.H. Wigg. (Diente de León), esta especie fue trabajada por Dean (1999) y realizó tintes con las flores únicamente y también otro tinte son las flores y hojas, los tonos fueron muy similares en la gama de amarillos y verdes con el uso de modificadores. Nuestros resultados en base a flores y hojas, muestran que la saturación del color es intensa en proceso post-mordentado y con el modificador sulfato de hierro obtenemos verde grisáceo oscuro, gris oliva claro y oliva-grisáceo se acuerdo a los tres tratamientos. Las especies destacadas con mayor potencial tintóreo de *Convolvulus arvensis, Hirschfeldia incana, Lepidium draba, Pimpinella anisum, Salsola kali var. kali y Sisymbrium austriacum,* que fueron estudiadas en este trabajo, no han sido nombradas en la bibliografía consultada como usadas para tal fin. Consideramos que este aporte al conocimiento es innovador y amplía el abanico de especies prometedoras. Lo expuesto anteriormente, determina que en la diversidad florística ruderal urbana de Comodoro Rivadavia se encuentran presentes recursos muy valiosos, disponibles en gran cantidad para su utilización en actividades artesanales tintoreras. Ello permite el desarrollo de emprendimientos tintoreros, mediante el uso de recursos sustentables, de excelentes cualidades, sin intervenir con la diversidad autóctona de la región patagónica, conservando y protegiendo el patrimonio florístico natural.

Contribución de los autores

SG realizó la dirección general del proyecto, planificación y sistematización de los procesos. Todos los autores participaron en la recolección del MVT, lecturas bibliográficas sobre experiencias previas. MS realizó los procesos mediante el tratamiento pre-mordentado. LC realizó los procesos mediante el tratamiento mordentado directo. AC realizó los procesos mediante el tratamiento post-mordentado. Todos los autores participaron en la confección de muestrarios y definición de colores con el uso de las tablas Munsell. SG realizó la determinación específica del MVT, confección de las tablas, análisis de resultados, preparación de figuras y gráficos, toma fotográfica testimonial de los procesos, de las especies en campo y de las lanas teñidas. Todos los autores participaron en la interpretación de resultados y SG realizó la redacción integral del manuscrito.

References Références Referencias

1. ARCE, M. E. & S. GONZALEZ. 2000. *Patagonia, un Jardín Natural.* Editoras. Comodoro Rivadavia, Chubut. Argentina.
2. ARIAS ROCHA, N. 2018. *Tintes naturales de origen vegetal para uso en el teñido de hilo de fibra natural.* Tesis de grado Licenciatura en Ingeniería Industrial de la Facultad de Ingeniería de la Universidad Mayor de San Andrés. La Paz, Bolivia.
3. ARROYO, D; GARAY, J.; DEMARÍA, M. & R. RAUBER. 2019. *Malezas del semiárido central argentino.* Ediciones INTA. Estación Experimental Agropecuaria San Luis.
4. BURGESS, R. 2011. *Harvesting color. How to find plants and make natural dyes.* Publish by Artisan. New York. Printed in China.
5. CALLAHAN, G. 2010. *Hand Dyeing. Yarn and fleece.* Toppan Leefung Printing. China
6. CANNON, J. & M. CANNON, 2003. *Dye Plants and dyeing.* Timber Press. North America. USA. Published in association with the Royal Botanic Gardens, Kew.
7. CARDON, D. 2007. *Natural Dyes. Sources, Tradition, Technology and Science.* Archetype Publications Ltd. UK
8. CARDON, D. 2010. Natural Dyes, our Global heritage of colours. Textile Society of America. 12 th Biennial Symposium. Lincoln, Nebraska
9. COLOR, B. M. (2009). *Munsell soil-color charts: with genuine Munsell® color chips.* Munsell., 4300 44TH street Grand Rapids MI, 49512.

10. CORRADINE MORA, M. 2014. *Guía para tintura con tintes naturales en lana para artesanos de los municipios Sutatausa, Tausa, Ubaté, Fúquene, Sesquilé y Villapinzón.* Laboratorio de diseño e innovación para Cundinamarca. Artesanías de Colombia.
11. CORREA, M. N. 1998. *Flora patagónica.* Colección científica. Instituto Nacional de Tecnología Agropecuaria. Buenos Aires. Argentina.
12. DE LA BANDERA, M. 2002. Manual de Plantas que tiñen en Uruguay. Colaboradores Dominique Loaec, D.; Frankl, S. y M. Bellone. Taller ¨La linterna¨. Parada 8 de la Laguna. Graphis Ltda. Pinares de Maldonado. Uruguay.
13. DEAN, J. 2010. *Wild Color. The complete Guide to Making and Using Natural Dyes.* Watson-Guptill Publications. New York.
14. DOGAN, Y., S. BASLAR, M. OZTURK & H. H. MERT. 2008. *Plants used as dye sources. Underutilized and underexploited horticultural crops.* Vol. 3, pp 109-145 New India Publishing Agency, New Delhi (India).
15. FORCONE, A. 2009. *Hierbas y arbustos frecuentes en el valle inferior del río Chubut. Una guía ilustrada para su reconocimiento.* 2da Edición. Bahía Blanca. Editorial de la Universidad Nacional del Sur.
16. GARTNER, E., ROJAS, G. & S. CASTRO 2015. Patrones composicionales de hierbas ruderales en Santiago, Chile. *Guayana Bot.* 72 (2) 192-202
17. GONZÁLEZ, S.; CORDERO, A. CASTRO, L. & M. SEGOVIA. 2020. Potencial tintóreo de las plantas autóctonas de la estepa, Dto. Escalante, Chubut, Patagonia Argentina. *Bol. Soc. Argent. Bot.* 55:641-660. DOI: https://doi.org/10.31055/1851.2372.v.55.n4.29305
18. KRÖPFL, A. & VILLASUSO, N. 2012. *Guía para el reconocimiento de species de los pastizales del monte oriental de Patagonia.* Con colaboración de Guadalupe Peter. 1 edición. Ediciones INTA
19. MARRONE, L. 2010 *Los colores de la tierra. Guía de teñido artesanal con tintes naturales.* Ed. Martin. Argentina.
20. MARTÍNEZ GARCÍA, M. J., M. L. VÁZQUEZ de ÁGREDOS PASCUAL, R. C. BOSH RUBIO. 2017. Los tintes naturales: su estudio y posibles aplicaciones en moda y diseño. *I Coloquio de Investigadores en textil y moda,* 166-171 pp. Barcelona.
21. MARTINEZ-DE LA CRUZ, I., VIBRANS, H., LOZADA-PEREZ, L. ROMEROMANZANARES, A., AGUILERA-GOMEZ, L. & I. RIVAS-MANZANO. 2015. Plantas ruderales del área urbana de Malinalco, Estado de Mexico, Mexico. *Botanical Sciences,* 93 (4) 907-919.
22. MARZOCCA, A. 1959. *Historia de plantas tintóreas y curtientes.* Colección Agropecuaria del I. N.T.A. Buenos Aires.
23. MARZOCCA, A. 2005. *Plantas exóticas colorantes o tintóreas cultivadas en la Argentina* Academia Nacional de Agronomía y Veterinaria.
24. MARZOCCA, A. 2009. *Compendio práctico de tintes naturales vegetales en la Argentina.* 1er Edición Buenos Aires. Orientación: Gráfica editora.
25. MENDEZ, E. 2005. Flora y vegetación del centro urbano de Lujan de Cuyo, Mendoza. Argentina. *Rev. FCAUN Cuyo* TOMO XXXVII N° 1 67-74.
26. MILÍA, E. B. 2011. *Manual de hilado artesanal y tintes naturales.* 1ra Edición. Secretaría de Cultura de Chubut.
27. POCHETTINO, M. L. 2015. *Botánica Económica. Las plantas interpretadas según tiempo, espacio y* cultura. Sociedad Argentina de Botánica. www.botanicargentina.com.ar
28. PORTILLO, L., J. ARCELIA & M. SANTANA. 2019. Fibras naturales y pigmentos: teñido, tejido y diseño. Centro Universitario de Arte y diseño. Guadalajara México. *Boletín Nakari3.*
29. QUINTANA, R. 2015. *Plantas de laPatagonia árida, nativas y exóticas delnorestedel Chubut.* Trelew.1ra Edición Remitente Patagonia.
30. RAPOPORT, E., A. H. LADIO & E. H. SANZ. 1999. *Plantas nativas comestibles de la Patagonia Andina argentino-chilena.* Parte I Dpto. deEcología Centro Regional Universitario Bariloche. Programa de Extensión Universitaria. Universidad Nacional del Comahue y National Geographic Society. Ediciones Imaginaria. Bariloche.
31. ROQUERO, A. & C. CÓRDOBA. 1981. *Manual de tintes de origen natural para lana.* 1ra Edición. Ediciones del Serbal. Barcelona. España.
32. STRAMIGIOLI, C. 2004. *Teñido con colorantes naturales. Recuperación de una técnica tradicional.* Galerna- Búsqueda de Ayllu. 3° Edición.
33. VEJAR, K. 2015. *The Modern Natural Dyer. A comprehensive Guide to Dyeing Silk, Wool, Linen and Cotton at Home.* Printed in China. Abrams The Art of Book. New York.
34. ZULOAGA, F. O., O. MORRONE & M. J. BELGRANO. 2017. *Catálogo de Plantas Vasculares del Cono Sur.* http://www.darwin.edu.ar/Proyectos/FloraArgentina/fa.htm [Acceso: Octubre 2020]

Fig. 7: Manzanilla cimarrona en flor. Colores obtenidos

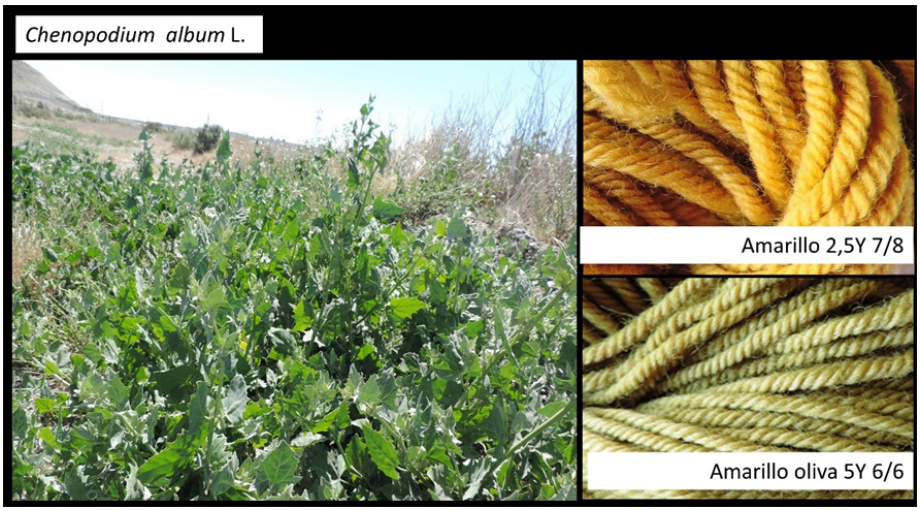

Fig. 8: Quinoa en zona urbana. Colores obtenidos

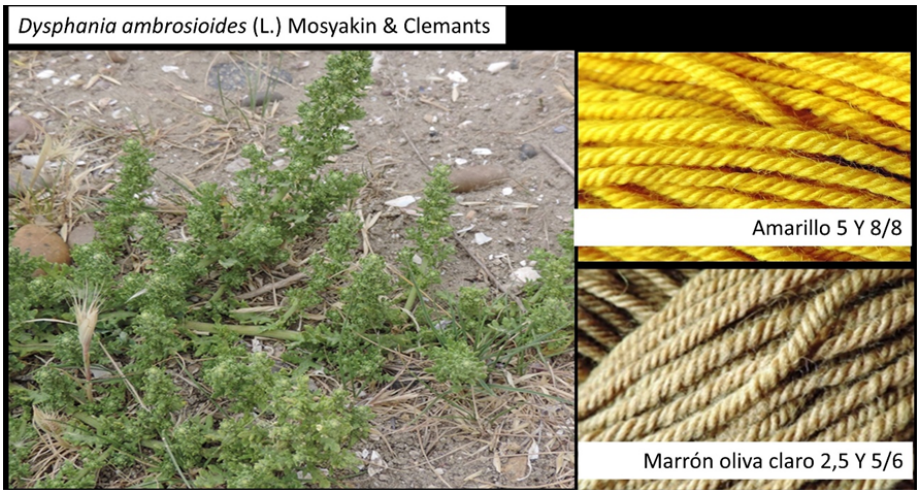

Fig. 9: Paico extendido sobre el sustrato. Colores obtenidos

Fig. 10: Infrutescencia de Lengua de vaca. Colores obtenidos

Fig. 11: Sanguinaria con su clásico desarrollo postrado. Colores obtenidos

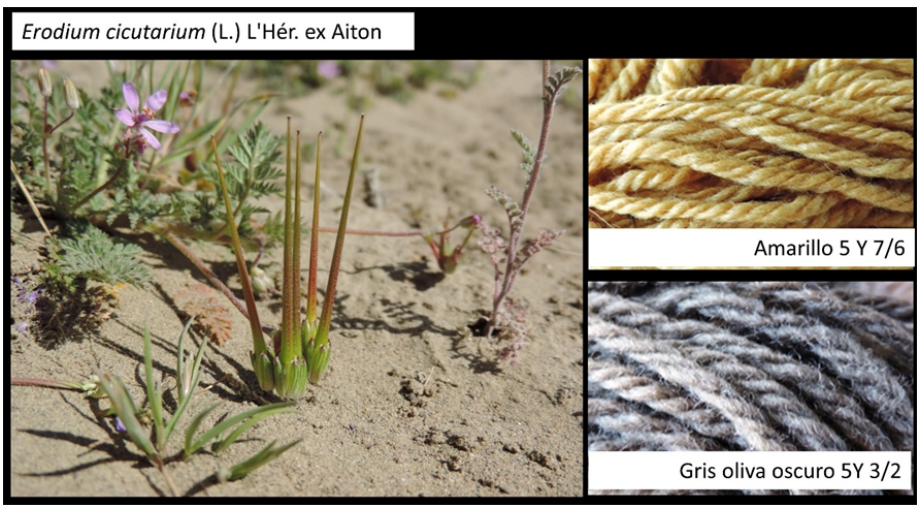

Fig. 12: Alfilerillo en flor y fruto. Colores obtenidos

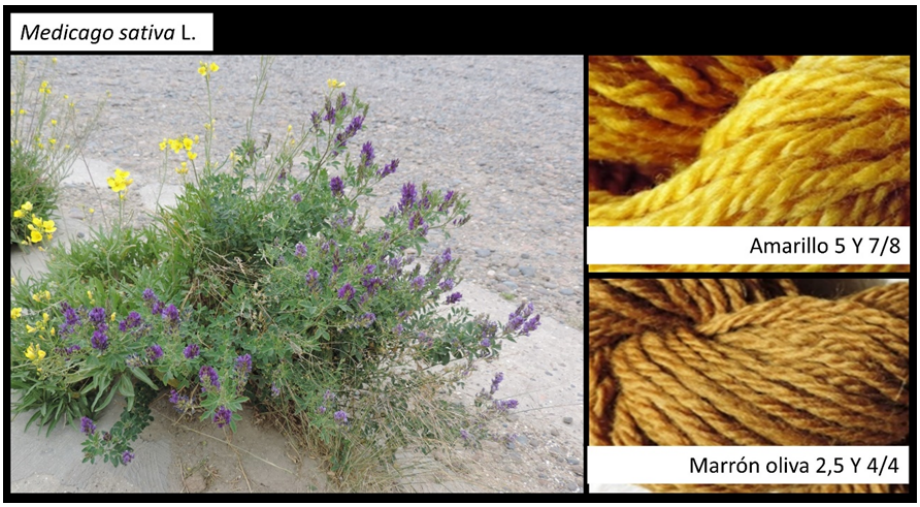

Fig. 13: Alfalfa en flor, comparte con Nabo, el sitio de vereda. Colores obtenidos

Fig. 14: Correhuela en flor. Colores obtenidos

Fig.15: Wency en flor. Colores obtenidos

Tabla 1: Listado de colores obtenidos mediante los diferentes tratamientos

Familia	Nombre científico	Nombre vernáculo	Parte utilizada	Alumbre			Bicarbonato de sodio			Sulfato de hierro		
				Pre-mordentado	Mordentado directo	Post- mordentado	Pre-mordentado	Mordentado directo	Post- mordentado	Pre-mordentado	Mordentado directo	Post- mordentado
Apiaceae	***Pimpinella anisum*** L.	ANÍS	R y H	MP 2,5 Y 8/3	MP 2,5 Y 8/3	A 2,5 Y 7/6	A 2,5 Y 8/8	A 2,5 Y 7/6	A 2,5 Y 7/6	MOC 2,5 Y 5/3	O 5 Y 5/4	O 5 Y 5/4
Asteraceae	***Anthemis cotula*** L. #	MANZANILLA CIMARRONA	R y H	A 5 Y 8/8	AP 5 Y 8/4	A 5 Y 8/8	AO 2,5 Y 6/8	A 5 Y 8/8	A 5 Y 8/8	OGMO 10Y 3/2	VO 5 GY 4/4	OP 10 Y 6/4
	Cichorium intybus L.	ACHICORIA	PE	MP 2,5 Y 7/3	MP 2,5 Y 8/3	AP 5 Y 8/4	MAC 10 YR 6/4	MP 2,5 Y 8/3	MP 10 YR 6/3	MAO 10 YR 4/4	MP 10 YR 6/3	OG 10 Y 5/2
	Taraxacum officinale F.H. Wigg.	DIENTE DE LEÓN	PE	MP 2,5 Y 8/4	MP 2,5 Y 8/3	A 5 Y 7/6	MP 2,5 Y 8/4	A 5 Y 8/8	A 5 Y 7/6	GOO 5Y 6/2	VGO 10Y 4/2	OG 10 Y 5/2
Chenopodiaceae	*Atriplex semibaccata* R. Br.	SARBUCHI	R y H	AP 5 Y 8/4	AP 5 Y 8/3	AP 5 Y 7/4	AP 5 Y 8/3	AP 5 Y 8/4	AP 5 Y 7/4	MO 5 YR 6/4	OP 5 Y 6/3	O 5 Y 5/4
	Chenopodium album L. #	QUINOA	R y H	AO 5Y 6/6	A 2,5Y 7/8	A 5 Y 8/8	AO 5Y 6/8	A 2,5Y 7/8	A 5 Y 8/8	OGMO 10Y 3/2	MO 2,5 Y 4/4	AO 5Y 6/6
	Dysphania ambrosioides (L.) Mosyakin & Clemants* #	PAICO	R y H	A 5 Y 7/8	A 5 Y 8/8	A 5 Y 7/8	A 5 Y 7/8	A 2,5 Y 5/8	A 5 Y 7/8	MOC 2,5 Y 5/6	AO 5 Y 6/8	MOC 2,5 Y 5/4
	Salsola kali L. var. ***kali***	CARDO RUSO	PE	AP 5 Y 7/4	AP 2,5 Y 8/3	A 10 YR 7/6	AP 5 Y 7/4	AP 2,5 Y 8/3	A 10 YR 7/6	OG 10 Y 5/2	MO 7,5 YR 6/3	MOC 2,5 Y 5/4
Cruciffera	***Hirschfeldia incana*** (L.) Lagr.-Foss.	NABO	PE	MP 2,5 Y 8/3	MP 2,5 Y 8/3	AR 7,5 YR 7/6	MP 2,5 Y 8/3	R 2,5 YR 8/4	M 10 YR 5/3	MA 10 YR 5/4	MMP 10 YR 7/4	M 10 YR 5/3
	Lepidium draba L.	WENCY	PE	A 2,5 Y 8/6	MP 2,5 Y 8/3	A 2,5 Y 8/8	A 2,5 Y 8/6	A 2,5 Y 8/6	A 2,5 Y 8/8	O 5 Y 5/4	OP 5Y 6/3	O 5 Y 5/4
	Sisymbrium austriacum Jacq	MOSTACILLA	PE	AP 5Y 8/3	MP 2,5Y 8/2	A 2,5Y 7/6	AP 5Y 8/3	MP 2,5Y 8/3	A 2,5Y 7/6	MA 10 YR 5/4	MP 10 YR 6/3	MMP 10 YR 7/4
Convolvulaceae	***Convolvulus arvensis*** L. *	CORREHUELA	R y H	A 2,5 Y 7/6	A 2,5 Y 8/6	A 2,5 Y 7/6	A 2,5 Y 7/6	A 2,5 Y 8/8	A 5 Y 8/6	O 5 Y 5/3	VGO 10 Y 6/2	VGO 10 Y 4/2
Fabaceae	***Medicago sativa*** L.	ALFALFA	R y H	AP 5 Y 8/4	A 5 Y 7/6	AP 5 Y 8/4	A 5 Y 7/6	A 5 Y 7/8	A 5 Y 8/6	MOC 2,5 Y 5/3	MO 2,5 Y 4/4	OP 5 Y 6/4
Geraniaceae	***Erodium cicutarium*** (L.) L'Hér. ex Aiton	ALFILERILLO	PE	MAC 2,5Y 6/4	A 5 Y 7/6	A 5 Y 7/6	MAC 2,5Y 6/4	A 5 Y 7/6	AP 5 Y 7/4	MOC 2,5Y 5/3	GOO 5Y 3/2	OGO 10Y 4/2
Lamiaceae	***Marrubium vulgare*** L. *	MALVA RUBIA	R y H	MP 2,5 Y 8/4	MP 2,5 Y 8/4	MP 2,5 Y 8/4	AP 5 Y 8/4	AP 5 Y 8/4	AP 5 Y 8/4	O 5 Y 5/3	AP 5 Y 8/4	OG 10 Y 5/2
Malvaceae	***Malva dendromorpha*** M.F. Ray	LAVATERA	R y H	AP 5Y 8/3	AP 5Y 8/4	AP 5Y 7/4	A 5Y 8/6	AP 5Y 8/3	AP 5Y 7/4	OP 5Y 6/4	AP 5Y 7/3	O 5Y 5/3
Plantaginaceae	*Plantago lanceolata* L.	SIETE VENAS	PE	MMP 10YR 8/2	MAC 10YR 6/4	MA 10YR 5/4	MMP 10YR 8/2	MAC 10YR 6/4	MA 10YR 5/4	G 10YR 5/1	M 10YR 5/3	M 10YR 4/3
Polygonaceae	***Polygonum aviculare*** L.	SANGUINARIA	R y H	A 2,5 Y 7/6	AP 5 Y 8/4	AO 2,5 Y 6/6	A 2,5 Y 7/8	A 5 Y 8/8	MP 2,5 Y 7/4	MO 2,5 Y 4/3	OP 5 Y 6/4	O 5 Y 4/3
	Rumex crispus L.	LENGUA DE VACA	R y H	AP 2,5 Y 8/4	A 2,5 Y 8/6	A 2,5 Y 8/6	A 10 YR 7/6	A 2,5 Y 8/8	A 2,5 Y 8/6	MA 10 YR 5/4	O 5 Y 5/3	VGC 5 GY 6/2

*Abreviaturas: R y H = Ramas y Hojas; PE= Planta entera; A= Amarillo; AO= Amarillo oliva; AP= Amarillo pálido; AR= Amarillo rojizo; G= Gris; GOC= Gris oliva claro; GOO= Gris oliva oscuro; M= Marrón; MA= Marrón amarillento; MAC= Marrón amarillento claro; MAO= Marrón amarillento oscuro, MC= Marrón claro; MMP= Marón muy pálido; MO= Marrón oliva; MOC= Marrón oliva claro; MP= Marrón pálido; O= Oliva; OG= Oliva grisáceo; OGMO= Oliva grisáceo muy oscuro; OGO= Oliva grisáceo oscuro; OP= Oliva pálido; R= Rosa; VGC= Verde grisáceo claro; VO= Verde oliva VGO= Verde grisáceo oscuro. Referencias: *= especie con homogeneidad cromática en los 3 tratamientos; especie recomendada= especie identificada con buen potencial tintóreo; #= especie destacada con excelente potencial tintóreo.*

Global Journal of Science Frontier Research (D) Volume XXI Issue IV Version I Year 2021
14

This page is intentionally left blank

Global Journal of Science Frontier Research: D
Agriculture and Veterinary
Volume 21 Issue 4 Version 1.0 Year 2021
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Knowledge and Attitude of Farmers of Small-Scale Dairy Farming at Dhaka, Bangladesh

By Arifur Rahman, Mahabbat Ali, Md. Uzzal Hossain, Mustasim Famous, Md. Ahsan Habib & Sabuj Kanti Nath

Khulna Agricultural University

Abstract- The major purpose of this research study was to determine dairy farmer's knowledge and attitude towards dairy farms and also to explore the relationships between each of 12 selected characteristics of the dairy farmers and their knowledge and attitude towards dairy farming. The study was conducted in 5 Thana's under Dhaka district. The populations of dairy farmers in five Thana's were 182 and sample size was 58 (random sampling method used). An interview schedule was used for data collection. The data were collected during 5 May to 5 August 2019. Scales were developed in order to measure the variables. Majority of the farmers (36.2%) had medium knowledge and 34.5% farmers had low and 29.3% had high knowledge on dairy farming. Regarding attitude, the study showed that about 50% of the respondents had high favorable attitude, 43.1% of the respondents had unfavorable attitude and 6.9% of the respondents had Neutral attitude towards dairy farming.

Keywords: *knowledge, attitude, sample size, variables.*

GJSFR-D Classification: *FOR Code: 070199*

Strictly as per the compliance and regulations of:

Knowledge and Attitude of Farmers of Small-Scale Dairy Farming at Dhaka, Bangladesh

Arifur Rahman [α], Mahabbat Ali [σ], Md. Uzzal Hossain [ρ], Mustasim Famous [ω], Md. Ahsan Habib [¥] & Sabuj Kanti Nath [§]

Abstract- The major purpose of this research study was to determine dairy farmer's knowledge and attitude towards dairy farms and also to explore the relationships between each of 12 selected characteristics of the dairy farmers and their knowledge and attitude towards dairy farming. The study was conducted in 5 Thana's under Dhaka district. The populations of dairy farmers in five Thana's were 182 and sample size was 58 (random sampling method used). An interview schedule was used for data collection. The data were collected during 5 May to 5 August 2019. Scales were developed in order to measure the variables. Majority of the farmers (36.2%) had medium knowledge and 34.5% farmers had low and 29.3% had high knowledge on dairy farming. Regarding attitude, the study showed that about 50% of the respondents had high favorable attitude, 43.1% of the respondents had unfavorable attitude and 6.9% of the respondents had Neutral attitude towards dairy farming. Age, level of education, annual income, Organizational participation, training received, extension media contact, Cosmopolitans, herd size and Annual recurring expenditure of the dairy farmers had significant positive relationship and problem faced by dairy farmer had negative significant relationship with their knowledge on dairy farming, while land holding and milk production had no significant relationship with their knowledge on dairy farming. The findings of the study revealed that vast majority of the farmers (70.7%) had low to medium knowledge on dairy farming. Attitude of the farmers is not up to mark. A proportion of 50 percent of the farmers had high favorable attitude towards various aspects of dairy farming.

Keywords: knowledge, attitude, sample size, variables.

I. Introduction

In Bangladesh, livestock is one of the most potential sub-sectors of agriculture which plays an indispensable role in promoting human health and national economy of the country. Based on the dairy cattle population, Bangladesh has secured 15th position among the top dairy cattle populated countries in the world (FAO, 2012). Dairy sector provides to nearly the triple benefits of nutritive food, supplementary income and productive labor to farm families (Singh R.V 2002). Livestock production systems in our country have been mostly primitive and unorganized. Over 70% of the milk produced in our country is by landless small and marginal farmers who own one or two animals. Dairying definitely offers itself as a prospective farm diversification means with immense commercial potential (Balaraman, 2004). It can be easily assumed that with the increase in the adoption of improved dairy practices the per capita availability of milk will increase. This undoubtedly requires change the attitude of farmers towards adopting improved dairy practices to get maximum profit. It is also required to speed of knowledge dissemination and adoption by dairy entrepreneurs (A.K. Singh, 2000).large attitude of dairy farmer forms and essential end for the better implementation and success of dairy development programme. Keeping this in view an attempt was made to ascertain the level of attitude 'of farmers towards improved dairy practices (Suresh, 2004). It is as above context; study was planned to investigate the exiting level of knowledge and attitude of dairy farmers towards improved of dairy practices of these milk producers will help to planner and dairy development agencies which can make positive effort in the development of dairy enterprise. The present study was, therefore, designed to know the socio-economic and psychological attributes of the selected dairy farmers. and to determine the level of knowledge towards improved dairy practices of selected dairy farmers.

II. Materials and Methods

The research was led at Mohammadpur, keraniganj, Jatrabari, Mirpur & Savar Thana under Dhaka district. These Thana's were purposively selected. This was because Dairy farmers more in this area than other area. Sample of The dairy farmers under selected five Thana's were considered as the population of the study. The total sample size stood at 58. Moreover, a reserved list of 7 dairy farmers was prepared for use when the dairy farmers under sample were not available during data collection. The dairy farmers under selected five Thana's were considered as the population of the study. A list of dairy farmers who are currently producing milk was prepared with the help of Department of livestock services and its field staffs. The number of dairy farmers of the selected five Thana's was 182 which constituted the population of the study.

Author α: MS, Department of Animal Production and Management, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.
Author σ: Assistant Professor, Department of Animal Production and Management, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. e-mail: mahabbat01sau@gamil.com
Author ρ ω ¥: Lecturer, Department of Livestock production and Management, Khulna Agricultural University, Khulna, Bangladesh.
Author §: Lecturer, Department of Animal Nutrition, Khulna Agricultural University, Khulna, Bangladesh. e-mail: sabuj.vet@gmail.com

About 30 percent of the population was selected proportionally from the selected Thana's as the sample by following random sampling method. Thus, the total sample size stood at 58. Moreover, a reserved list of 7 dairy farmers was prepared for use when the dairy farmers under sample were not available during data collection.

For the purpose of data collection, a semi-structured interview schedule was used. It was prepared keeping the objectives of the study in mind. The interview schedule contained both open and closed form questions. Direct and simple questions and statements were included in the schedule to collect data on the selected dependent and independent variables. Data were collected through personal interviewing by the researcher herself through face to face interview. The study was purposively conducted in the Dhaka district of Bangladesh. Before starting collection of data, the researchers met with department of livestock services (DLS) in order to explain the objectives of the study and requested them to provide necessary help and co- operation in collection of data. As a result, there was no problem to collect data. The researcher made all possible efforts to establish rapport with the respondents so that they could feel comfortable to the questions which contained in the schedule. All possible efforts were made to explain the purpose of the study to the respondents and their answers were recorded sincerely. Collection of data took 90 days from 5 May to 5 August 2019.

The different characteristics of the dairy farmers might have impact on their knowledge and attitude towards dairy farm practices. These characteristics were like age, education, land holding, annual income, Organizational participation, Training received, Extension contact, Cosmopoliteness, Herd size, Annual recurring expenditure, Milk production, problem faced for dairy farming were the main center of the study. Measurement of all the factors of the dairy farmers and their knowledge and attitude towards dairy farming are discussed in the following sub sections:

a) Age

It refers to the chronological age of the respondents (in years) rounded to the nearest whole number at the time of interview. It was ascertained by direct questioning and a unit score was given to each year. Age of a respondent was measured in terms of years from birth to the time of interview which was found on the basis of response (Adnan, 2016).

b) Statistical Analysis

The data were analyzed in accordance with the objectives of the study. Qualitative data were converted into quantitative data by means of suitable scoring technique wherever necessary. The statistical measures such as range, means, standard deviation, number and percentage distribution were used to describe the variables. Initially, Pearson's Product Moment Coefficient of Correlation (r) was used in order to explore the relationships between the concerned variables. One percent (0.01) level of probability and five percent (0.05) level of probability were the basis for rejecting any null hypothesis throughout the study. The SPSS computer package was used to perform all these process

III. Results and Discussion

The purpose of this section is to explore the relationships of the selected characteristics of the dairy farmers with their knowledge on dairy farming. Pearson's Product Moment co-efficient of correlation (r) was used to test a null hypothesis concerning the relation between any two variables. Five percent (0.05) and one percent (0.0l) level of probability was used as the basis for rejection of a null hypothesis. Results of the test of co-efficient of correlation between each of the selected characteristics of the farmers and their knowledge on farming are shown in table 4.16.

Table 1: The Pearson's correlation showing relationship between dependent (Knowledge of the farmers towards Dairy farm) and independent variables

Dependent Variable	Independent Variable	Value of Co-efficient Correlation	Table Value Significant at 56 df	
			0.05% level	0.01% level
Knowledge of the farmers towards dairy farming	Age	.309*	0.218	0.335
	Education	.683**		
	Land holding	-.057		
	Annual Income	.535**		
	Organizational Participation	.687**		
	Training received	.814**		
	Extension Media Contact	.898**		

	Cosmopoliteness	.523**
	Herd Size	.530**
	Annual Recurring Expenditure	.539**
	Milk Production	.177
	Problem Faced for Dairy farm	-.299*

* *Significant at 0.05level ,** Significant at 0.01 level*

a) *Relation between age and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between age of the farmers and their knowledge on dairy farm was found to be .309 (table 1). The findings indicated that the age of the dairy farmers was insignificant. So, there is no relationship of age of the farmers with their knowledge on dairy farming. Roy (2006) found that age of the farmer had no significant relationship with their knowledge on dairy farming. Similar result was observed by Anu (2016), Monalesa (2014), Khan (2005), Islam (2005) and Rahman (2004) in their respective studies.

b) *Relation between education level and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between education level of the farmers and their knowledge on dairy farming was found to be 0.683** (table 1). Based on the above findings, it can be concluded that education of the dairy farmers was positively significant. So, there is a positive relationship of education of the farmers with their knowledge on dairy farming. Similar result was observed by Rahman (2015) and Monalesa (2014) in their respective studies.

c) *Relation between land holding and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between farm size of the farmers and their knowledge on dairy farming was .057 (table 1). Based on the above findings, it can be concluded that of the dairy farmers was negatively insignificant. So, there is no relationship of land holding of the farmers with their knowledge on dairy farming. Similar result was observed by Monalesa (2014) & Chowdhury (2014) in their respective studies.

d) *Relation between annual income and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between annual income of the farmers and their knowledge on dairy farming was 535** (table 1). The findings indicated that the annual income of the dairy farmers was positively significant. So, there is positive relationship of annual income of the farmers with their knowledge towards dairy farming. Similar result was observed by Rabby (2014) & Amin (2006) in their respective studies.

e) *Relation between organizational participation and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between organization participation of the farmers and their knowledge on dairy farming was 0.687** (table 1). The findings indicated that the organization participation of the dairy farmers was significant. So, there is positive relationship of organizational participation of the farmers with their knowledge on dairy farming.

f) *Relation between Training received and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between Training received of the farmers and their knowledge on dairy farming was found to be 0.814** (table 1). The findings indicated that the Training received of the dairy farmers was significant. So, there is positive relationship of organization participation of the farmers with their knowledge on dairy farming.

g) *Relation between extension media contact and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between extension media contact of the farmers and their knowledge on dairy farming was found to be 0.898** (table 1). The findings indicated that the extension media contact of the dairy farmers was positively significant. So, there is positive relationship of extension media contact of the farmers with their knowledge on dairy farming. Similar result was observed by Anu (2016), Rahman (2015), Monalesa (2014) and Chowdhury (2014) in their respective studies.

h) *Relation between cosmopoliteness and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between cosmopoliteness of the farmers and their knowledge on dairy farming was found to be 0.523** (table 1). The findings indicated that the cosmopoliteness of the dairy farmers was significant. So, there is positive relationship of cosmopoliteness of the farmers with their knowledge on dairy farming.

i) *Relation between Herd size and knowledge of the farmers towards dairy farming*

Computed value of the co-efficient of correlation between herd size of the farmers and their knowledge on dairy farming was found to be 0.530** (table 1). Based on the above findings, it can be concluded that

herd size of the dairy farmers was positively significant. So, there is a positive relationship of herd size of the farmers with their knowledge on dairy farming. Similar result was observed by Monalesa (2014) & Chowdhury (2014) in their respective studies.

j) Relation between Annual recurring expenditure and knowledge of the farmers towards dairy farming

Computed value of the co-efficient of correlation between Annual recurring expenditure of the farmers and their knowledge on dairy farming was found to be 0.539** (table 1). The findings indicated that the Annual recurring expenditure of the dairy farmers was significant. So, there is positive relationship of Annual recurring expenditure of the farmers with their knowledge on dairy farming.

k) Relation between Milk production and knowledge of the farmers towards dairy farming

Computed value of the co-efficient of correlation between Milk production of the farmers and their knowledge on dairy farming was found to be 0.177 (table 1). The findings indicated that the Milk production of the dairy farmers was insignificant. So, there is no relationship of Milk production of the farmers with their knowledge on dairy farming.

l) Relation between problems faced for dairy farming and knowledge of the farmers towards dairy farming

Computed value of the co-efficient of correlation problem faced for dairy farming of the farmers and their knowledge on dairy farming was found to be -0.299*(table 1).The findings indicated that problem faced for dairy farming of the dairy farmers was negatively significant. So, there is negative relationship of problem faced for dairy farming of the farmers with their knowledge on dairy farming. Similar result was observed by Rahman (2015) and Monalesa (2014) in their respective studies.

m) Relationship between the selected characteristics of the respondents and their attitude towards dairy farming

To examine the relationship of the nine selected characteristics of the respondents with their attitude towards dairy farming was the purpose of this section. The twelve selected characteristics were: age, education, land holding, annual income, Organizational participation, Training received, Extension contact, Cosmopoliteness, Herd size, Annual recurring expenditure, Milk production, and problem faced for dairy farming. These nine selected characteristics were the independent variables while attitude towards tobacco cultivation was the dependent variable of this study.

Pearsons product moment correlation co-efficient (r) has been used to explore the relationships between the selected characteristics of the respondents with their attitude towards dairy farming. Five percent (0.05%) and one percent (0.0l %) level of probability was used as the basis for rejection of a null hypothesis. Results of the test of co-efficient of correlation between each of the selected characteristics of the farmers and their attitude towards dairy farming are shown in table 4.17.

Table 2: The Pearson's correlation showing relationship between dependent (attitude towards dairy farming) and independent variable

Dependent Variable	Independent Variable	Value of Co-efficient Correlation	Table Value Significant at 56 df	
			0.05%	0.01%
Attitude towards dairy farming	Age	.328*	0.218	0.335
	Education	.545**		
	Land holding	-.065		
	Annual Income	.639**		
	Organizational Participation	.700**		
	Training received	.702**		
	Extension Media Contact	.802**		
	Cosmopoliteness	.493**		
	Herd Size	.464**		
	Annual Recurring Expenditure	.523**		
	Milk Production	.124		
	Problem Faced for Dairy farm	-.222		

* *Significant at 0.05level,** Significant at 0.01 level*

n) Relation between age and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between age of the farmers and their attitude towards dairy farming was found to be .328* (table 2). The findings indicated that the age of the dairy farmers was significant. So, there is positive relationship of age of the farmers with their attitude towards dairy farming. Similar result was observed by Monalesa (2014) and Amin (2006) in their respective studies.

o) Relation between education and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between education of the farmers and their attitude towards dairy farming was found to be 0.545** (table 2). The findings indicated that the education of the dairy farmers was positively significant. So, there is positive relationship of education of the farmers with their attitude towards dairy farming. Similar result was observed by Rahman (2015) in his study.

p) Relation between land holding and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between farm size of the farmers and their attitude towards dairy farming was found to be -.065 (table 3). The findings indicated that the farm size of the dairy farmers was negatively significant. So, there is no relationship of land size of the farmers with their attitude towards dairy farming. Similar result was observed by Monalesa (2014), Rabby (2014) and Amin (2006) in their respective studies.

q) Relation between annual income and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between annual income of the farmers and their attitude towards dairy farming was found to be .639** (table 2). The findings indicated that the annual income of the dairy farmers was positively significant. So, there is positive relationship of annual income of the farmers with their attitude towards dairy farming. Similar result was observed by Rabby (2014) & Amin (2006) in their respective studies.

r) Relation between organizational participation and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between organization participation of the farmers and their attitude on dairy farming was found to be 0.700** (table 2). The findings indicated that the organization participation of the dairy farmers was significant. So, there is positive relationship of organization participation of the farmers with their attitude on dairy farming.

s) Relation between Training received and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between organization participation of the farmers and their attitude on dairy farming was found to be 0.702** (table 2). The findings indicated that the organization participation of the dairy farmers was significant. So, there is positive relationship of organization participation of the farmers with their attitude on dairy farming.

t) Relation between extension media contact and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between extension media contact of the farmers and their attitude on dairy farming was found to be 0.802** (table 2). The findings indicated that the extension media contact of the dairy farmers was positively significant. So, there is positive relationship of extension media contact of the farmers with their attitude on dairy farming. Similar result was observed by Anu (2016), Rahman (2015), Monalesa (2014) and Chowdhury (2014) in their respective studies.

u) Relation between cosmopoliteness and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between cosmopoliteness of the farmers and their attitude on dairy farming was found to be 0.493** (table 2). The findings indicated that the cosmopoliteness of the dairy farmers was significant. So, there is positive relationship of cosmopoliteness of the farmers with their attitude on dairy farming.

v) Relation between Herd size and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between farm size of the farmers and their attitude on dairy farming was found to be 0.464** (table 2). Based on the above findings, it can be concluded that farm size of the dairy farmers was positively significant. So, there is a positive relationship of herd size of the farmers with their attitude on dairy farming. Similar result was observed by Monalesa (2014) & Chowdhury (2014) in their respective studies.

w) Relation between Annual recurring expenditure and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between Annual recurring expenditure of the farmers and their attitude on dairy farming was found to be 0.523* (table 2). The findings indicated that the Annual recurring expenditure of the dairy farmers was significant. So, there is positive relationship of Annual recurring expenditure of the farmers with their attitude on dairy farming.

x) Relation between Milk production and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation between Milk production of the farmers and their attitude on dairy farming was found to be 0.124 (table 2). The findings indicated that the Milk production of the dairy farmers was insignificant. So, there is no relationship of

Milk production of the farmers with their attitude on dairy farming.

y) Relation between problems faced for dairy farming and attitude of the farmers towards dairy farming

Computed value of the co-efficient of correlation problem faced for dairy farming of the farmers and their attitude on dairy farming was 0.222 (table 2). The findings indicated that problem faced for dairy farming of the dairy farmers was negatively significant. So, there is negative relationship of problem faced for dairy farming of the farmers with their attitude on dairy farming. Similar result was observed by Rahman (2015) and Monalesa (2014) in their respective studies.

IV. Conclusion

Knowledge of the farmers had significant positive relationship with their education, annual income, organization participation, training received, cosmopoliteness, herd size, annual recurring expenditure. While knowledge of the farmers had negatively significant with their dairy farming problem. Therefore, it may be concluded that it would be a wishful thinking to improve the overall situation of knowledge by taking care of the factors related to the increase of knowledge among the farmers.

References Références Referencias

1. Adnan. M. F. (2016). Factors influence sustainable access to rural financial services. M.S.Thesis, Dept. Of Agricultural Extension and Information System, SAU, Dhaka.
2. Amin. M. A. K. (2006). Farmers' attitude towards use of pesticides. M.S. Thesis, Dept. Of Agricultural Extension and Information System, SAU, Dhaka.
3. Amin, M.S. (2001). Impact of Training on Transfer of Aquaculture Technologies in Some Selected Areas of Jamalpur District. M.S. (Ag. Ext. Ed.) Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh.
4. Anu. M. R. H. (2016). Farmers' knowledge and practice on plant Nursery management. M.S. Thesis, Dept. Of Agricultural Extension and Information System, SAU, Dhaka.
5. Balaraman N. (2004). Establishment of commercial dairy farm: challenges and opportunities. Paper presented in xxxiii dairy industry conference, 26 Sep, 2004, New Delhi.
6. Bangladesh Bureau of Statistics. Report of the Household Income and Expenditure Survey (2000). Dhaka, Government of Bangladesh, Ministry of Planning, 2003.
7. Chowdhury. M. H. B (2014). Farmers' knowledge of sheep rearing in Bhuapurupazila under Tangail district. Thesis, Dept. Of Agricultural Extension and Information System, SAU, Dhaka.
8. FAO (2012) Food Agriculture Organization.
9. Monalesa, N. (2014). Farmers' Knowledge and Attitude towards Summer Tomato Cultivation. M.S. Thesis, Dept. of Agricultural Extension and Information System, SAU, Dhaka.
10. Rabby, M. T. R. (2014). Farmers' Attitude towards Jute Cultivation. M.S. Thesis, Dept. Of Agricultural Extension and Information System, SAU, Dhaka.
11. Rahman. M. A. (2015). Farmers' Knowledge and Attitude Regarding Cultivation of Salt Tolerant Variety (BRRI dhan 47) Of Rice. M.S.Thesis, Dept. Of Agricultural Extension and Information System, SAU, Dhaka.
12. Rahman, M.S. (2004). Extent and Level of Knowledge of Farmers on HYV Boro Rice Cultivation Practices. M.S. Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
13. Singh, A.K. (2001) Economic analysis of technological change in milk production in Karnal district of Haryana. M.Sc. Thesis, NDRI, Karnal.
14. Singh S.K., Singh, M.K. and A.K. Singh (2000). Dairy development in Uttar Pradesh through Pradeshik Co-operative Dairy Federation compendium on livestock in different farming system. TamilnaduVete. Animal Sci. Uni. Chennai. PP- 84.
15. Singh, M. Dubey, M.K. and Y.R. Khare (2003). Factors affecting adoption of dairy management practices by- members of dairy co-operative society. Ind. Res. J.of Ext. Edu. 3(2): 25-28.
16. Suresh, (2004) Entrepreneurial behaviour of milk producers in Chittoor district of Andhra Pradesh- A critical study. M. V. Sc. Thesis, Acharya N. G. Ranga Agricultural University, Hyderabad.

Global Journal of Science Frontier Research: D
Agriculture and Veterinary
Volume 21 Issue 4 Version 1.0 Year 2021
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

On-Farm Hormonal Oestrus Synchronization and Mass Insemination Technique of Dairy Cattle in Sidama, Ethiopia

By Debir Legesse Belay & Sandip Banerjee
South Agricultural Research Institute

Abstract- This study aimed to evaluate the efficiency of oestrus synchronization and mass insemination under the action research and development intervention. For the evaluation, a total of 126 and 883 dairy cattle were taken under action research and development intervention, respectively. The result of estrus response (90%) in action research was somewhat higher than the result obtained from development intervention (87.2%). The number of AI services per conception in action research was (1.75) lower than the development interventions (2.36). The result of conception was higher (58.4%) under action research than the development intervention (42.2%). The result further revealed that both in action research and development intervention conception significantly ($P<0.05$) affected by genotypes. Conception was higher in the 2nd parity both in action research and development intervention.

Keywords: action research, synchronization, AI, dairy cattle, conception rate, sidama.

GJSFR-D Classification: FOR Code: 070799

Strictly as per the compliance and regulations of:

On-Farm Hormonal Oestrus Synchronization and Mass Insemination Technique of Dairy Cattle in Sidama, Ethiopia

Debir Legesse Belay [α] & Sandip Banerjee [σ]

Abstract- This study aimed to evaluate the efficiency of oestrus synchronization and mass insemination under the action research and development intervention. For the evaluation, a total of 126 and 883 dairy cattle were taken under action research and development intervention, respectively. The result of estrus response (90%) in action research was somewhat higher than the result obtained from development intervention (87.2%). The number of AI services per conception in action research was (1.75) lower than the development interventions (2.36). The result of conception was higher (58.4%) under action research than the development intervention (42.2%). The result further revealed that both in action research and development intervention conception significantly ($P<0.05$) affected by genotypes. Conception was higher in the 2nd parity both in action research and development intervention. The BCS was higher ($P<0.05$) among the cattle with a higher conception rate. Conception also significantly varied across cows' age, with higher values observed among those aged between 5 to 7 years. Conception rate was a significant ($P<0.05$) difference among the time of insemination, with higher results observed between 10 to 15 hours after the onset of estrus. Results from action research and development intervention indicated a possibility to improve the conception rate by 16.2%. Therefore, appropriate animal selection, semen quality, and the time of insemination need to be considered for a successful estrous synchronization and AI program.

Keywords: action research, synchronization, ai, dairy cattle, conception rate, sidama.

I. Introduction

Artificial insemination (AI) is a proven bio-technique, used globally to improve the genetic makeup and efficiency of reproduction performance in cattle (Noakes, 2009). However, the AI service in Ethiopia was not successful in improving the reproductive performance of the dairy industry (Sinishaw, 2005). Due to poor heat detection, the timing of insemination, embryonic mortalities, inadequate infrastructure and poor management system the efficiency of the AI service in Ethiopia is one of the lowest among the developing countries (Shiferaw *et al.,* 2003). According to Haileyesus (2006), the average number of services per conception (NSPC) among local and crossbreed cows was 2.54 and 2.38, respectively.

Author α: South Agricultural Research Institute, Hawassa Agricultural Research Center, Hawassa, Ethiopia. e-mail: debirlegese@gmail.com
Author σ: Hawassa University, College of Agriculture, Hawassa, Ethiopia.

One of the ways to overcome the challenges of low conception rates and less efficient AI service is by using hormones for estrous synchronization, thus facilitating the practical use of artificial insemination, and this can positively influence the productive, and reproductive efficiency of dairy cattle (Murugavel *et al.,* 2010). The use of reproductive hormones can help in the planning of AI in a way that coincides with planned parturitions in a specific period. Thus to synchronize the estrus cycle of cattle, PGF2α or its analog is a commonly used hormone, the functionality of which depends on the presence of at least a functional corpus leuteum (CL) in the diestrus stage of the estrous cycle (7 to 17 days of the cycle) (Cordova-Izquierdo *et al.,* 2009).

To overcome such constraints, estrus synchronization combining with artificial insemination (AI) was introduced as a tool to improve the reproductive performance of cattle (Cordova *et al*., 2009). To this effect, the benefit of using such a technological option is an approach to improve desirable animal genetic materials. Therefore to boost the dairy industries and to alleviate the problems of the aforementioned gaps, evaluation of the effect of Prostaglandin on estrus synchronization of dairy cattle under small holders' conditions is indispensable. Therefore, the objectives of the study were to evaluate the success associated with estrus synchronization and mass insemination at development intervention, re-evaluating the technology through action research, and draw recommendations for the sustainable application of this technology in the study area.

II. Materials and Methods

a) Description of the Study Areas

The study was conducted at Arbegona and Bensa districts of Sidama zone, Southern Region. Geographically, Sidama zone is situated between the coordinates of 5045' and 6045' N latitude and 38039' and 38029' E longitude with altitude ranging from 1100 to 3500 m asl. The rainfall pattern of the zone is a bimodal type with a small rainfall amount during February to April followed by the main rainy season from July to September. It has diverse agroecology classified as highlands, midlands, and semi-dry lowlands covering

30%, 60%, and 10%, respectively. The farming system of the zone is characterized as a mixed type of crop and livestock farming and endowed with different livestock resources such as cattle, sheep and goats, equines, and poultry.

b) Evaluation of Synchronization and Mass Insemination in Development Intervention

The performance of the Oestrus synchronization and mass AI program assessed using secondary data from the respective Agricultural Office of Bensa and Arbegona districts. A total of 883 dairy cattle data included in the study. For this evaluation, oestrus response, conception rate, and number of services per conception are taken as dependent variables. Likewise, the independent variables were genotype, parity zero to multiparas, BCS (1 to 9 scale) following Nicholson (1986), age of animals, insemination time, and bull semen. For comparing of action research conducted by Irrigation Value Chains for Ethiopian Smallholders (LIVES) projects of International Livestock Research Institute (ILRI) project and development interventions carried out by each district of BoA compared with results from action research activities conducted in the same area.

c) Evaluation of Estrous Synchronization and Mass AI in Action Research

In the experiment, A total of 126 cows selected from Bensa district based on the presence of receptive corpus luteum and absence of pregnancy upon rectal palpation, parity (1st to 5th level), in good health status, and BSC (1 to 9 scale) following Nicholson (1986), and treated with a single injection of PGF2α (5 ml Lutalyse™) hormone. At the end of the study period, hormone response after injection of PGF2α, conception rate (CR), and the number of services per conception determined (NSPC) as dependent variables. The independent variables/factors were genotype, BCS, age of cows, parity of cows, time of AI, and bull itself.

d) Heat Detection and Insemination Procedure

Before the commencement, farmers were trained about how to detect estrus/heat in their breeding females. The cows were inseminated according to AM/PM method as suggested by Peter (2004). One well-experienced and trained inseminator was assigned for insemination to avoid any ambiguity of differences arising due to the efficiency of the inseminators. The inseminator through rectal palpation assessed the stage of estrus when the animals were brought to the AI center. The cows inseminated after they showed signs of standing estrus (heat) that ranged between 24 to 120 hours post-PGF2α administration with frozen semen (100%) of Holstein Friesian bulls.

e) Data Analysis

The efficiency of estrus synchronization and the association between CR, number of service per conceptions, and determining factors such as location, BCS, parity, breed, age, time of insemination, and bull IDs were analyzed using the chi-square test. The variation between groups was considered significant when the P-value was less than 0.05. CR and NSPC compute according to the method suggested by (Sharifuzzaman *et al.,* 2015).

$$\text{NSPC} = \frac{Total\ No.cows\ service}{Total\ No.cows\ conceived}$$

$$CR = \frac{Numberofcows\ /\ heifers\ pregnant}{Numberofcows\ /\ hefers\ inse\min ated} * 100$$

III. Results and Discussion

a) Performance of Oestrus Synchronization and Mass Insemination

The rate of oestrous response to hormone treatment, measured as the percentage of females that showed oestrus out of the total treated animals under regular development intervention by the responsive BoA, was comparable to the result obtained in action research activity. The rate of Oestrus response in action research and development intervention presented in Table1. The result of response rate in action research was 90%, somewhat higher than with that of development intervention (87.2%), still, it was lower than those reported by Azage et al*. (*2012) (97.7%) in Dale district and Tewodros et al.(2015) (98.9%) in Fogera district. The rate of estrus response of action research and development intervention was slightly similar to Adebabay *et al.* (2013) (89.3%) in Bahir Dar milk shed, however, it was higher than from the reported of Bekana (2005) 82%. The differences in estrus response among the studies attributed to body condition score, age of the animals, breeding season, no-cyclic animals, and disease (Tewodros *et al.,* 2015).

In the current study, interval to oestrus response after PGF2α in action research was shown slightly longer than that of regular development intervention (Table 1).The present finding was higher than those reported by Hamid (2012) 57.9 hrs in Siltie, and Adebebay et al*.* (2013) 51 and 50 hrs in Bahirdar; however it was lower than those reported by the report of Azage et al*.* (2012) 13 to 154 hours in Hawassa-Dilla milkshed, and Million et al*.* (2011) 70.67 hours for Boran cattle. This longer or shorter estrus response interval most likely due to poorly developed ovaries and early stages of CL during the administration of PGF2α.

b) Conception Rate and Number of Service per Conception

As shown in Table 1, there was an enormous variation between conceptions under action research (57.45%) and development intervention (42.2%) of the current study districts. However, the conception rate

both in action research and development intervention was better than that reported by Adebabay et al. (2013) 13.3 % in Bahir Dar and Desalegn (2008) 27% in Ethiopia. In contrast, the rate of conception was lower with the preliminary results of mass synchronization in SNNPR (62.2%) and Tigray (62%) reported by (Azage, 2012).

The average NSPC in action research was lower than that of development intervention (Table 1). The number of service per conception result under action research was lower than those reported by Hyleyesus (2006) for the local (2.54) and crossbreed (2.38) cattle, but it was higher than what was described by (Menal et al., 2011; Nibret, 2012) 1.25 and 1.3, respectively, but it was in line with the report (1.75) of Sharifuzzaman et al. (2015). Negussie (1992) also indicated that high NSPC is associated with poor semen quality, semen handling, and insemination practices.

Table 1: Oestrous response, oestrus interval,conception rate and number of service per conception

Variables	No. cows	Oestrus response (%)	Oestrus interval (hrs.)	CR (%)	NSPC
Development intervention	883	87.2	62.1±2	42.2	2.36
Action research	126	90	61.1±1.2	58.4	1.75

Factors affecting the performance of Conception rate

a) Effect of Genotype

In development intervention, the rate of conception (CR) was a significant difference ($P \leq 0.05$) among the genotypes, but, in action research, there was no significant difference among the local and crossbred cattle. Irrespective of the studies, the conception rate of crossbred is higher than the local cattle. The lower conception rate among the native cattle attributed to the silent heat observed in zebu cattle (Azage et al*.,* 1989). The difference among the reports might be the time of insemination, heat detection efficiency, breeding season, proper semen handling, and intrinsic factors of the cow itself. Similar studies made by Mollal (2011) and Shikder (2011) in his report CR depends mainly on skills of the inseminator, accurate estrus detection, quality and quantity of spermatozoa in semen, proper semen thawing procedure, and placement of semen in the uterus.

b) Effect of Parity and Age

The results of conception in development intervention did not differ ($P>0.05$) among the parties, but significant ($P<0.05$) variation observe in action research (Table 2). The performance of conception was higher among the cows aged between 5 to 7 years; this roughly corresponds to the second and third parity of the cows and decreases as the parity number increased. The finding of the results was in line with several other studies that reported that the conception was better among the cows at the second parity (Miah et al*.,* 2004; Khan et al*.,* 2008; Bhattacharyya et al., 2009). The present result showed that as animals' age increases, the CR shows a negative trend, this may be associated with lactation stress, and also that the older cows tend to gain weight, thereby reducing the chances of fertility. Irrespective of all the above conditions about poor CR among the older ages in cows align with the studies by Gebregziabher (2005), it indicated that reduction in the probability of conception with increased age of the cow attributed to the exposure of the cows to different reproductive diseases, older cows and post-partum anoestrus.

c) Effect of Body Condition Scores

Conception rates both in action research and development intervention were significantly ≤(P0.01) affected by the BCS (Table 2). A similar study by Grimard *et al.* (2003) indicates that the effectiveness of the AI depends on the BCS of the cows. Shamsuddin *et al.* (2001)and Emebet (2007) also stated that animals with optimum body conditions at insemination had better fertility than those with poor or higher BCS. The variation can be non-genetic factors viz. availability of feed source, season, and year besides assessing the optimal body condition for a particular breed. Studies by Bó et al. (2003) and Hossain (2013) indicated that sub-optimal BCS could be a fallout of poor nutritional status that is often observed among the cattle grazing on degraded pastures, especially in the tropics.

Table 2: Effect of parity, age and body condition scores on conception rate

Development intervention			Action Research		
Variables	No.of animals	CR%	Variables	No. of animals	CR%
Genotypes			Genotypes		
Crossbred	53	54.7[a]	Crossbred	41	68.4[a]
Local	723	41.3[b]	Local	85	53.3[b]
Parity			Parity		
0	132	37.12[a]	1	26	57.7[a]
1	59	42.4[a]	2	36	69.4[a]
2	164	48.2[a]	3	21	66.7[a]
3	221	42.5[a]	4	19	36.8[b]
4 and above	200	40.5[a]	5	11	36.4[b]
Age			Age		
3 to 4	124	37.1[b]	3 to 4	17	52.9[b]
5 to 7	379	50.13[a]	5 to 7	68	70.6[a]
Above 7	273	33.7[b]	8 and 9	28	32.14[c]
BCS			BCs		
4.5	200	33[c]	4.5	28	25[c]
5	428	42.8[b]	5	49	65.3[b]
5.5	94	53.2[a]	5.5	16	68.7[b]
6	54	53.7[a]	6	20	80[a]

Where,[a-c] $P \leq 0.05$ across column

d) Effect of Time of Insemination

The results of studies both in action research and mass insemination indicated that conception rate was higher ($P<0.05$) when the cows were inseminated within 10 to 15 hrs. intervals after the onset of estrus, indicating the validity of AM/PM approach, however, the CR lower when insemination done after 20 hours of estrus (Table 3). Although the appropriate time of insemination in both studies was between 10 to 15 hours of the onset of estrus, the differences as observed could be associated with several non-genetic factors as mentioned ahead. Probably this interval was too short for the time of ovulation. A similar report by Mufti et al. (2010) indicated that the conception was higher when inseminated between 10 to 14 hours after the onset of estrus, but lower CR observed among the cows inseminated earlier or later the above mentioned period. The observations are in close accordance with the findings of Miah *et al.* (2004) indicate that if insemination is carried out later than 22 hours results in poor conception. The variation in conception rate among different studies could be due to inaccuracy of heat detection, time and season of insemination, skills of the AIT. A Study by Sinishaw (2005) also indicated that animals should inseminate within 24 hours of the onset of heat because late and early insemination may influence the CR of cows.

e) Effect of Bull

Conception rate was a significant variation between bulls ID itself inseminated to the responded cows and higher conception rate observed in bull numbers 10-264 and 10-293 (Table 3). The difference might be related either due to the level of skill and experience difference of AI technicians on the thawing method, site of semen deposition and heat detection error or quality of the semen, etc. A study by Mufti et al. (2010) indicated that the effect of thawing at different periods of interval influenced the conception rate significantly. Other studies also reported that the quality of frozen semen has a significant result on CR (Shamsuddin et al., 2001; Anzar et al., 2003).

Table 3: Effect of time of insemination and bull itself on conception rate

Development intervention			Action Research		
Variables	No. of animals	CR%	Variables	No. of animals	CR%
Time of Insemination			Time of Insemination		
4.9 - 10	248	43[a]	5.4 - 10	33	48.5[b]
11-15	315	49[a]	11-15	49	76.6[a]
16 to 20	112	41[a]	16 to 20	22	43.2[b]
>21	101	17.8[b]	>21	9	20.7[c]
Bull ID			Bull ID		
10-202	76	50[a]	10-264	64	64.2[a]
10.204	323	43.6[a]	10-218	24	50[a]
10-217	118	44.9[a]	10-293	25	56[a]
10-218	61	21.3[b]			
10-232	198	41.9[a]			

Where,[a-c] P≤0.05 across column

f) Estrus Detection Time

After PGF2α administration most of the cows' estrus sign was observed during the night than days (Figure 1). The observations are in line with the findings of Bekana et al. (2005), who reported that in Fogera cattle, most of the estrus signs observe during the cooler hours of the night. Higher CR also observed when the AI was carried out before noon, indicating that CR was better when AI was conducted at cooler hours of the day (Nordin et al., 2004). Proper detection of estrus is difficult, especially when the cows exhibit during the night hours, thus unless or until the cows monitored regularly to assess the time of standing heat and AI (Aulakh, 2008).

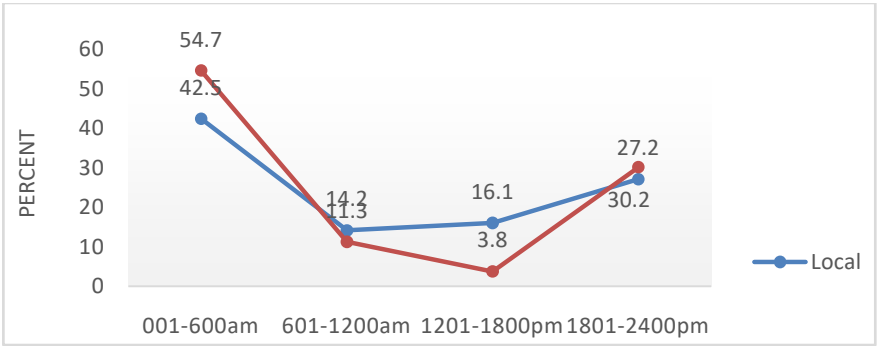

Figure 1: Estrus Detection time

IV. Conclusion and Recommendations

The rate of oestrus response (90% of the case) in action research was slightly higher than the result obtained from development intervention (87.2% of the case). The rate of conception (58.4%) in action research was higher than that of the development intervention (42.2%). Therefore, result from action research and the development intervention AI service with estrus synchronized indicates a possibility to improve the conception rate by 16.2%. The average NSPC under action research was lower (1.7) than that of the development intervention (2.36). The conception rate in action research was higher in the 2nd parity, while the same was higher in the 2nd parity under the development intervention. Appropriate timing of insemination in action research and development intervention was 10 to 15 hr. after the onset of estrus. However, conception was lower when insemination carried out after 15 hours of AI. In conclusion, the action research result revealed that the efficiency of development intervention carried out by BoA significantly improved if proper synchronization and AI practices have to be place before the commencement of the program. Animal selection (appropriate age, BCS, and parity), breeding season, heat detection efficiency, and farmers' awareness to detect heat and on-time bringing of cattle for insemination, presence of AI technicians at station should be duly considered for effective synchronization and insemination.

Acknowledgements

This research was financially supported by the Livestock and Irrigation Value Chains of Ethiopian Smallholders (LIVES) project, ILRI, and the South Agricultural Research Institute (SARI). A special acknowledgment and credit goes to the principal project investigator, the late Dr. Azage Tegegne, for his restless effort and mentoring of the research work. The authors appreciate the integration and cooperation offered by experts working at Livestock and Fishery Development

Offices of the respective district to assist during the fieldwork. We highly recognize the AI technicians for their unreserved support and full involvement during the mass insemination and data collection. Finally, the authors fully acknowledge and appreciate the research participants, mainly cattle owners of the sample districts.

References Références Referencias

1. Adebebay Kebede, Getinet Zeleke, Yeshwas Ferede, Temesegen Abate, and Azage Tegegne. 2013. Prostaglandin (PGF2α) based oestrous synchronization in postpartum local cows and heifers in Bahir Dar milkshed, Int. J. Pharm. Med. & Bio. Sc. 2(4):35-37.
2. Anazar M., Zarooq U., Mirza M.A., Shahab M., and Ahmad N. 2003. Factors affecting the efficiency of Artificial insemination in cattle and buffalo in Punjab, Pakistan Vet. J. 23(3).
3. Aynalem Haile, Workneh, A., Noah K., TadeleDessie, and AzageTegegne. 2011. Breeding strategy to improve Ethiopian Boran cattle for meat and milk production. IPMS of Ethiopian farmers' project working paper 26.Nairobi, Kenya, ILRI.
4. Azage T., Warnick A.C., Mukassa-Mugerwa E. &Ketema H.1989. Fertility of Bosindicus, and Bosindicus x Bostaurus crossbred cattle after estrus synchronization.Theriogenology31.361-369.
5. Azage T., Awete E., Asrat T., and Dirk H. 2012. Technological options and Approaches to improve smallholder access to desirable animal genetic martial for Dairy development: for dairy development: IPMS experience with synchronization and mass insemination. Tropentag, Göttingen. www.ipms-ethiopia.org.
6. Bekana M., Gizachew A. and Regassa F. 2005. Reproductive Performance of Fogera heifers treated with prostaglandin F2α for synchronization of oestrus. Tropical Animal health and Production, 37(5).373-379.
7. Bhattachharyya H.K., Fazili M.R,, Khan I., and Bhat FA.2009. Fertility status of artificial inseminated crossbred cows of Kashmir Valley. Asian J.Anim, Sci. 56-63.
8. Bó G.A., Baruselli P.S. and Martinez M.F. 2003. Pattern and manipulation of follicular development in *Bosindicus* cattle. Animal Reproduction Science 78, 307–326.
9. Cordova-Izquierdo A.C.A., Cordova-Jimenez M.S, Cordova-Jimenez C.G., and Ruiz L.J.A. 2009. Oestrus synchronization and percentage of pregnancy in dairy calves using prostaglandins by two via of administration, Australian Journal of Basicand Applied Sciences, 3(3) 2834- 2837.
10. Desalegn Gebremedhin. 2008. Assessment of problems/constraints associated with artificial insemination service in Ethiopia. MSc thesis, Addis Ababa University, Ethiopia.
11. Emebet Mureda, and Zeleke Mekuriaw Z. 2007. Reproductive Performance of Crossbred Dairy Cows in Eastern lowlands of Ethiopia. Livestock Research for Rural Development. *19(161).* http://www.lrrd.org/lrrd19/11/mure19161.htm
12. Gebregziabheir G., Azage T., Diedhious M.L, and Hegde B.P. 2005. Days to first service period of Indigenous and Crossbred Cows in Relation to Postpartum Body weight change at Bako, Ethiopia. .J. Anim. Prod.5 (1).77-89.
13. Haileyesus A. 2006. Evaluation of artificial insemination service efficiency and reproductive performance of Friesian crosses North Gondar Zone, MSc Thesis, Alemaya University Ethiopia.
14. Hamid J. 2012. Study on Factors Affecting the Success of Artificial Insemination Program in Cattle, Siltie Zone. Degree of Master of Science in Veterinary Obstetrics and Gynaecology.
15. Hossain M.D. 2013. Evaluation of rates of post AI pregnancy, calving and peri-parturient disorders of heifers in selected char area of Bangladesh.MS Thesis, Department of Surgery and Obstetrics Faculty of Veterinary Science. Bangladesh Agricultural University, Mymensingh
16. Khan M.R.K. 2008. Post Artificial Insemination conception rate in cattle at Bangladesh Agricultural University Veterinary Clinic, Master of Science Thesis, Department of Surgery and Obstetrics, Bangladesh Agricultural University, Mymensingh.
17. Menale M., Mekuriaw Z., Mekuriaw G., and Taye M. 2011.Reproductive performance of Fogera cattle at Metekel Cattle Breeding and Multiplication Ranch, North West Ethiopia. Journal of Animal and Feed Research, 1(3).99-106.
18. Miah A.G., Salma U., and Hossain M.M. 2004.Factors Influencing conception rate of local and crossbred cows in Bangladesh. International Journal of Agriculture and Biology, 6(5), 797-801.
19. Million T., Theingthan J., Pinyopummin A., Prasanpanich S., and Azage T. 2011. "Oestrus Performance of Boran and Boranx Holstein Fresian Crossbred Cattle Synchronized with a protocol based on Estradiol benzoate or Gonadotrophin-Releasing Hormone".
20. Mollal F.K. 2011. Post AI conception rate in zebu cows at Shaghata Upazilla of Ghaibandha. MS Thesis, Department of Surgery and Obstetrics, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh.
21. Mufti M.M.R., Alam M. K., Sarker M.S., Bostami M. R., and DasN. G. 2010. Study on Factors Affecting the Conception rate in Red Chittagong Cows. Bang. J. Anim. Sci. 39(1&2). 52 – 57.
22. Murugavel K., Yanize J.K., Santolaria M., Lopez B. & Lopez-Gatius F. 2010. Prostaglandin based estrus

synchronization in Post-Partum dairy cows. The international Journal of Applied Research in Veterinary Medicine.
23. Nibret M. 2012. Study on Reproductive Performance of Crossbred Dairy Cows under Small Holder Conditions in and Around Gondar, North Western Ethiopia. Journal of Reproduction and Infertility 3:38-41.
24. Nicholson M.J, and Butterworth M.H. 986. A Guide for condition scoring of Zebu cattle. International Livestock Center for Africa, Adiss Ababa.
25. Negussie E. 1992. Reproductive performance of local and crossbred dairy cattle at Assela
26. Livestock farm. Arsi, Ethiopia. MSc Thesis, Alemaya University of Agriculture, Ethiopia.
27. Noakes D.E., Parkinson T.J., Engl. and G.C.W. 2009.Veterinary Reproduction and Obstetrics. 8th ed. China, Sounders Elsevier, pp. 750-760.
28. Nordin Y., Zaini N., and. Wan Zahari W.M. 2004.Factors affecting conception rate in dairy cows under selected smallholder production system. J. Trop. Agric. and Fd. Sc. 32(2).219–227.
29. Shamsuddin M. Bhuiyan M.M.U., Sikder T.K., Sugulle A.H., Chanda P.K., Alam M.G.S, and Galloway D. 2001. "Constraints limiting the efficiency of artificial insemination of cattle in Bangladesh", Radioimmunoassay and related Techniques to Improve Artificial Insemination.
30. Sharifuzzaman., Jalil AM., Barman SC., Matin MA., Rokonuzzaman Md, and Ashadul Haque Md. 2015.Comparative study on conception rate in indigenous and crossbred cows after artificial insemination. Bangladesh International Journal of Natural and Social Sciences. 2. pp 9-12.
31. Shiferaw Y., Tenhagen B. A., Bekana M., and Kassa T. 2003. Reproductive performance of crossbred cows in different production systems in the central highlands of Ethiopia. Trop. Anim. Health and Prod. 35. 551-561.
32. Shikder A. 2011. Post AI Pregnancy rate of crossbred and zebu cattle using frozen semen at devhata and kaligonjupazilla in Satkhira district. MS in theriogenology Thesis. Department of Surgery and Obstetrics, Faculty of Veterinary Science, Bangladesh Agricultural.
33. Sinishaw W. 2005. Study on semen quality and field efficiency of AI bulls kept at the National Artificial Insemination Center. MSc thesis, Addis Ababa University, Faculty of veterinary Medicine, Debre Zeit. Ethiopia.13-17.
34. Tewodros A., Wondifraw M., Guadie M, and Zewdu A. 2015. Study on the Conception Rate of Dairy Cows Artificially Inseminated During Natural Heat and by Synchronization in Fogera District, North-West of Ethiopia. African Journal of Basic and Applied Science 7(5).291-297.

Global Journal of Science Frontier Research (D) Volume XXI Issue IV Version I Year 2021
28

This page is intentionally left blank

Global Journal of Science Frontier Research: D
Agriculture and Veterinary
Volume 21 Issue 4 Version 1.0 Year 2021
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Assessment of Butachlor, Diuron and Atrazine + Alachlor for Weed Management in Okra

By Obiazi, Christian Chukuka
Delta State University

Abstract- Weed interference decreases okra (*Albelmoschus esculentus* (L.)Moench) yields. Weeding is mostly manual with drudgery and cost, unlike the use of herbicides. Herbicides identified for okra productivity are few and scarce. Objectives of this experiment are to evaluate the tolerance and development of okra to three frequently used herbicides. But achlor, diuron and atrazine+alachlor, at 2.0, 3.6 and 3.3 kga.i./ha, respectively, were screened for weed control in okra. Hoe-Weeded (HWC) and un-weeded plots (WDC) served as controls. Data collected were subjected to statistical analysis. Okra establishment was in the order of 91.8% (HWC)> 89.0% (butachlor)> 86.8% (WDC)> 70.8% (atrazine+alachlor)> 51.9% (diuron). But achlor at 2.0kg a.i./ha was safe on okra. Diuron at 3.6kg a.i./ha was severely (7.8) phytotoxic, while atrazine+alachlor at 3.3kg a.i./ha was moderately (4.4) phytotoxic on okra, on 0-10 scale. Shoot biomass of 7.35g/plant in okra grown in butachlor treated plots were similar to 7.90g/plant in HWC, and greater than 1.4g/plant in diuron treated plots, 3.5 and 3.45g/plant in atrazine+alachlor and WDC, respectively. The herbicides had better weed control than WDC. Butachlor had no phytotoxic effect on okra and had okra establishment and shoot biomass comparable with HWC and should be listed for weed control in okra production.

Keywords: *herbicide screening, okra establishment, weed control.*

GJSFR-D Classification: *FOR Code: 070308*

Strictly as per the compliance and regulations of:

Assessment of Butachlor, Diuron and Atrazine + Alachlor for Weed Management in Okra

Obiazi, Christian Chukuka

Abstract- Weed interference decreases okra (*Albelmoschus esculentus* (L.)Moench) yields. Weeding is mostly manual with drudgery and cost, unlike the use of herbicides. Herbicides identified for okra productivity are few and scarce. Objectives of this experiment are to evaluate the tolerance and development of okra to three frequently used herbicides. But achlor, diuron and atrazine+alachlor, at 2.0, 3.6 and 3.3 kga.i./ha, respectively, were screened for weed control in okra. Hoe-Weeded (HWC) and un-weeded plots (WDC) served as controls. Data collected were subjected to statistical analysis. Okra establishment was in the order of 91.8% (HWC)> 89.0% (butachlor)> 86.8% (WDC)> 70.8% (atrazine+alachlor)> 51.9% (diuron). But achlor at 2.0kg a.i./ha was safe on okra. Diuron at 3.6kg a.i./ha was severely (7.8) phytotoxic, while atrazine+alachlor at 3.3kg a.i./ha was moderately (4.4) phytotoxic on okra, on 0-10 scale. Shoot biomass of 7.35g/plant in okra grown in butachlor treated plots were similar to 7.90g/plant in HWC, and greater than 1.4g/plant in diuron treated plots, 3.5 and 3.45g/plant in atrazine+alachlor and WDC, respectively. The herbicides had better weed control than WDC. Butachlor had no phytotoxic effect on okra and had okra establishment and shoot biomass comparable with HWC and should be listed for weed control in okra production.

Keywords: herbicide screening, okra establishment, weed control.

I. Introduction

Okra (*Albelmoschus esculentus* (L.)Moench) is a highly nutritive fruit vegetable which is rich in vitamins, iron and iodine, yet its growth and development is greatly limited by weed interference, particularly at the early growth stage. Adeyemi *et al.* (2014) reported that uncontrolled weed interference in okra resulted in 50.1% okra fresh pod yield loss. Manual weeding is the popular weed management strategy in okra production in most places. The use of herbicides is a convenient weed control method under large–scale operation. Dittmar & Stall (2019) reported that herbicides tagged for use in okra production are severely limited. Pendimethalin as a suitable herbicide for okra production in the rainforest ecological zone of Asaba, Nigeria has been reported by Obiazi *et al.* (2020). However there is still need to identify many more herbicides for weed management in okra. Among some herbicides that are frequently used for weed control in the rainforest zone of Nigeria are butachlor, diuron and a combination of atrazine+alachlor. Butachlor is a pre-emergence herbicide generally recommended for weed control in upland or paddy rice production. Butastar used in this study has butachlor as active ingredient and it is the first listed herbicide for upland or paddy rice. Butachlor is also recommended in combination with some herbicides as post emergence spray and is reported to control most annual weeds (NACWC, 1994). (Konlan*et al.* (2016) noted that diuron suppresses weeds for a prolonged period in pineapple, plantain, banana, sugarcane, yam and cassava. Diuron, is an effective broad-spectrum herbicide for both annual grassy and broadleaf weeds in pre and post-emergence control. NACWC (1994) reported that atrazine + alachlor are recommended for weed control in maize, a commonly cultivated crop, at the rate of 2.5 - 3.0 kga.i./ha in Nigeria. This study was therefore set up to identify more herbicides for okra production by evaluating the selectivity on okra and weed control efficacy of butachlor, diuron and atrazine+alachlor, that have been found to effectively control weeds in widely cultivated crops in the rainforest ecology.

Author: Department of Agronomy, Delta State University, Asaba Campus, Asaba, Nigeria. e-mail: ciciobiazi@gmail.com

II. Materials and Methods

a) Experimental Site

The field experiment was conducted in the Teaching and Research farm of Department Agronomy, Forestry and Wildlife, Delta State University, Asaba Campus, Asaba, Nigeria in the rainy seasons of 2013 and 2014. Asaba lies within latitude 6^0 14^1N and longitude 6^0 49^1E in the rainforest zone of Southern Nigeria.

b) Procurement of Seeds

A commonly grown early maturing local okra cultivar, *Ozigolo*, which was used for the study, was purchased from Oki market in Agbor, Delta State, Nigeria.

c) Land Preparation Experimental Layout and Design

The land preparation was done manually with a total of fifteen plots marked out. Each plot measured 2 m by 2 m with 1 m between plots and 1.5 m separating replicates. The experimental treatments consisted of pre-emergence application of butachlor at 2.0 kg a.i./ha, diuron at 3.6 kg a.i./ha and atrazine + alachlor (1:1)) at 3.3 kg a.i./ha. Plots hoe-weeded at 3 and 6 Weeks After Sowing (WAS) and weedy check which involved non-removal of weeds throughout the experiment served as controls to compare the pre-emergence herbicide

treatments and estimate the loss in growth due to uncontrolled associated weeds. Hoe was used to remove weeds in plots designated for hoe-weeded control at three and six WAS. Five treatments of the study were laid out in a Randomized Complete Block Design (RCBD) and replicated thrice.

d) Seed Protection and Plant Protection Treatments

The seeds were soaked overnight in water and air dried under shade to enhance germination. The air dried seeds were dressed with Apron star at the rate of 10 g Apron star per 4 kg of seeds. Apron star which contained both insecticide and fungicide was for protection of okra from pests and diseases, its active ingredients are 200/Kg Metalaxyl–M, 20g/Kg Difenoconazole and 200g/Kg Thiamethoxam (Syngenta, 2017).

Cypermethrin was used at the rate of one ml per litre of water to spray the okra plants against pests at 3, 5 and 7 WAS.

e) Seeding and Thinning of Seedlings

Three okra seeds were sown per hole at an average depth of two cm on the flat at a spacing of 50 x 50 cm, resulting in 16 stands per plot and 40,000 stands/ha. At 3 WAS the okra seedlings were thinned to one seedling per stand after taking the phytotoxicity readings.

f) Application of Fertilizer

The sandy loam soil had pH value of 5.9 and 6.0 and total N of 1.1 and 1.0 g/ kg in 2013 and 2014, respectively. Fifty kg of N/ha was applied using urea as the source of nitrogen, 50% of the fertilizer was applied at three weeks growth stage while the second dosage was applied three weeks later.

g) Herbicide Application

A CP knapsack sprayer, delivering 265 l/ha fitted with polijet nozzle, was used to apply the herbicides.

h) Experiment Duration

The experiment was established on the 10th of May in 2013, while in 2014, the planting of okra and pre-emergence application of the herbicides was carried out on the 6th of May, 2014. The experiment studied the growth of okra as affected by pre-emergence application of butachlor, diuron and atrazine+alachlor for eight weeks.

i) Data Gathered

i. *Phytotoxicity Rating*

Phytotoxicity rating on okra seedlings was taken at three weeks after sowing using the scale of 0-10 where 0 means no damage and 10 denotes total kill.

ii. *Okra Establishment*

Okra establishment was taken at eight weeks after sowing by counting all the established stands per plot.

iii. *Okra Growth Parameters*

The okra growth parameters taken at eight weeks after sowing were number of leaves per plant, number of branches per plant, stem diameter at 10 cm height, stem height and shoot biomass. Data on the effects of treatments on okra growth were taken from four tagged stands located in central rows of each plot; the mean for the four measurements represent the okra growth response in each plot.

iv. *Weed Control Efficacy*

Effects of treatments on weed control efficacy of the tested herbicides were assessed by taking data on weed biomass at 4, 6 and 8 WAS using a quadrat of 50 cm by 50 cm dimension. The quadrat was randomly placed within the plots in two locations per plot. All the weeds within the quadrats were collected, dried in the oven at 70 ^{0}C to constant weight. Dry weeds were weighed using Citizen Electronic Balance with maximum capacity of 2 000 g.

The weed control efficacy for each of the treatments was calculated based on the method used by Prachand*et al.* (2015) as shown below:

$$WCE\ \% = \frac{WD\ c - WDt}{WD\ c} \times \frac{100}{1}$$

Where,
WCE = Weed Control Efficacy (%)
WDc = Weed biomass (g/m^2) in weedy control plot
WDt = Weed biomass (g/m^2) in treated plot.

j) Statistical Analysis

Data concerning okra establishment and weed control efficacy were transformed to square root scale of $\sqrt{x+0.5}$ and analyzed as suggest by (Little & Hills, 1978). Data obtained with respect to the treatments were subjected to analysis of variance and treatment means separated using Least Significant Difference (LSD) tests at 5 % level of probability.

III. Results

a) Phytotoxicity

The pre-emergence herbicide applications had significant phytotoxic effect on okra plants at 3 WAS (Table 1.0). Okra grown in plots that received pre-emergence application of butachlor at 2.0 kg a.i./ha did not display any phytotoxic effect; the outlook of the okra plants compared with the ones grown in un-treated plots in 2013 and 2014. Okra grown in plots treated with diuron at 3.6 kg a.i./ha had the highest average phytotoxicity values of 7.8, this value was significantly greater than 4.4 observed in okra grown in in plots treated to atrazine + alachlor (1:1) applied at 3.3 kg a.i./ha. Atrazine + Alachlor used at 3.3 kg a.i/ha was less injurious to okra plant than diuron used at 3.6 kg a.i./ha in this study. Okra showed high sensitivity to pre-emergence application of diuron used at 3.6 kg a.i. /ha.

Table 1: Effects of pre-emergence herbicide applications on the phytotoxicity, number of leaves per plant, stem height and stem diameter of okra plants

Treatment	Phytotoxicity Rating at 3 WAS	No. of leaves / plant at 8 WAS	Stem height (cm) at 8 WAS	Stem dia. (cm) at 8 WAS
2013				
Butachlor at 2.0 kg a.i./ha	0.0c	7.3b	78.1a	2.4ab
Diuron at 3.6 kg a.i./ha	7.8a	4.0 c	20.0d	0.7c
Atr +Ala at 3.3 kg a.i./ha	4.8b	5.7bc	55.5b	1.8b
Hoe-weeded at 3 and 6 WAS	0.0c	11.0a	52.1b	3.1a
Weedy	0.0c	7.0b	36.9c	0.8c
SE ±	0.54	1.21	3.48	0.41
2014				
Butachlor at 2.0 kg a.i./ha	0.0C	9.7a	67.8a	2.3a
Diuron at 3.6 kg a.i./ha	7.7a	7.3a	28.2c	1.0b
Atr +Ala at 3.3 kg a.i./ha	4.0b	7.0 a	21.0c	2.1a
Hoe-weeded	0.0c	9.3 a	57.0a	2.9a
Weedy	0.0c	9.3 a	41.7b	0.9b
SE ±	0.59	1.48	5.25	0.44
Average				
Butachlor at 2.0 kg a.i./ha	0.0 c	8.5 b	73.0 a	2.4 a
Diuron at 3.6 kg a.i./ha	7.8 a	5.7 c	24.1 d	0.9 c
Atr +Ala at 3.3 kg a.i./ha	4.4 b	6.4 c	38.9 c	2.0 b
Hoe-weeded	0.0 c	10.2 a	54.6 b	3.0 a
Weedy	0.0 c	8.2 b	39.3 c	0.9 c
SE ±	0.55	0.75	2.21	0.21

Means within a column followed by the same letter(s) in the same year do not differ significantly at 5% level of probability using LSD.

WAS = Weeks After Sowing

Dia = Diameter, Atr +Ala =Atrazine +Alachlor, Hoe-weeded = Hoe-weeded at 3 and 6 WAS

b) Number of leaves per plant

Number of leaves per plant ranged from 4.0 to 11.0 (Table 1.0). In 2013, okra grown in plots that were hoe-weeded at 3 and 6 weeks after sowing had significantly greater number of leaves per plant (11.0) than what was obtained in any other treated plots (4.0 - 7.3) in 2013, but in the 2014, all the treatments had similar number of leaves which ranged from 7.3 to 9.7. On the average, number of leaves per plant in hoe-weeded (10.2) was similar to 8.5 in butachlor treated plots but greater than what was obtained in diuron and alachlor + atrazine treated plots, 4.0 – 5.7 and 7.0 – 7.3, in 2013 and 2014, respectively (Table 1).

c) Stem height

Plants of okra in butachlor treated plots were the tallest in 2013 and 2014 with heights of 78.1 cm and 67.8 cm in 2013 and 2014, respectively (Table 1.0). In 2013, okra grown in diuron treated plots were significantly the shortest in height of 20.0 cm and these were even significantly shorter than what was obtained in weedy plots (36.9 cm). In 2014, shortest okra plants were in plots that received pre-emergence application of atrazine + alachlor at 3.3 kg a.i./ha (21.0 cm). On the average, stem height as shown in Table 1, were in the order of butachlor (73.0 cm) > hoe-weeded (54.6 cm) > weedy (39.3 cm) = atrazine + alachlor (38.3 cm) >diuron (24.1 cm).

d) Stem diameter

The stem diameter differed significantly due to different weed control methods applied in both years (Table 1). The thickest stem among the pre-emergence herbicide treatments of 2.4 cm in 2013 and 2.3 cm in 2014 were found in plots treated with butachlor at 2.0 kg a.i./ha. The thinnest stems of 0.70 cm in 2013 and 1.0 cm in 2014 were found in plots treated with diuron at 3.60 kg a.i./ha. The average stem thickness ranged from 0.9 cm (weedy control and diuron) to 3.0 cm (hoe-weeded plots). That of butachlor of 2.4 cm was similar to that of hoe-weeded plots.

e) Okra establishment

Method of weed control had significant effect on average percentage okra establishment (Figure 1). Mean okra establishment ranged from 43.8 % (diuron at 3.6 kg a.i./ha) to 97.9 % (un-weeded in plots). Okra grown in hoe-weeded plots had the highest mean establishment (92.6%) which was similar to what was

obtained in un-weeded plots (91.7%) and plots treated with butachlor at 2.0 kg a/i./ha (90.6%), these were significantly better than the establishment level of okra plants grown in plots treated to atrazine + alachlor (1:1) used at 3.3 kg a.i./ha (75.0%). Okra grown in plots treated with diuron at 3.6 kg a.i./ha had the least average establishment level of 53.2% at eight WAS. Among the pre-emergence herbicides, the highest average okra establishment was in butachlor of 90.6 % which was significantly greater than 70.8 % observed in plots treated to atrazine + alachlor (1:1) which was also significantly greater than 53.2 % establishment level in plots that received pre-emergence application of diuron at 3.6 kg a.i./ha.

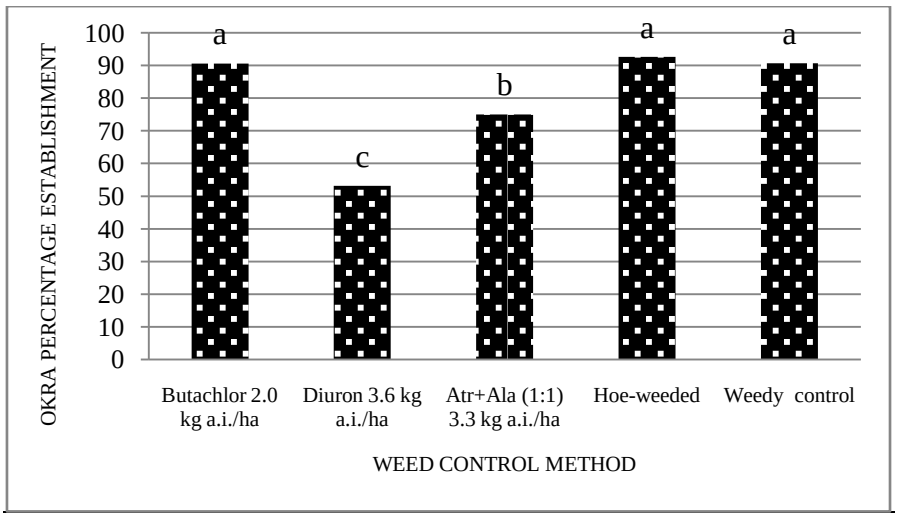

Figure 1: Effects of pre-emergence herbicide applications on okra percentage establishment per plot (Values are averages for 2013 and 2014)

Values with similar letter do not differ significantly at 5% level of probability using LSD.
Atr+ala = Atrazine + Alachlor, Hoe-weeded = Hoe-weeded at 3 and 6 weeks after sowing, Weedy = Un-weeded throughout the experiment.

f) Shoot biomass

Pre-emergence herbicide applications had significant effect on okra mean shoot biomass. Maximum average okra shoot biomass (7.9 g/plant) was produced on plots hoe-weeded at 3 and 6 WAS. The least okra shoot biomass (1.4 g/plant) was produced on plots sprayed diuron at 3.6 kg a.i. /ha. Mean shoot biomass were in the order 7.9 g/plant (Hoe-weeded) = 7.4 g/plant (butachlor) > 4.7 g/plant (atrazine + alachlor) 3.5 g/plant (weedy) >1.4 g/plant (diuron).

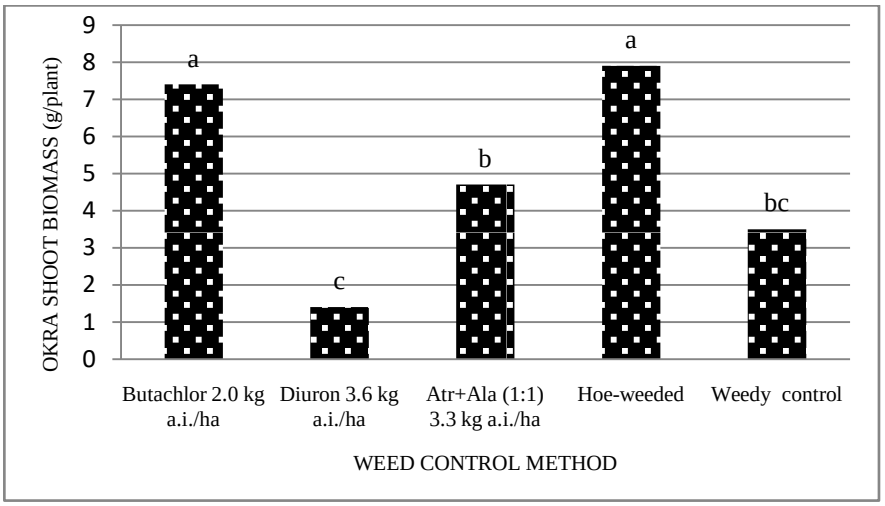

Figure 2: Effects of pre-emergence herbicide applications on okra shoot biomass. (Values are averages for 2013 and 2014)

Values with similar letter(s) do not differ significantly at 5% level of probability using LSD.
Atr+ala = Atrazine + Alachlor, Hoe-weeded = Hoe-weeded at 3 and 6 weeks after sowing, Weedy = Un-weeded throughout the experiment.

g) Weed biomass

All the weed control treatments had less weed biomass than un-weeded control plots at four, six and eight WAS in 2013 and 2014 (Table 2.0).

The three herbicides had similar weed biomass at 4 WAS which ranged from 1.6 to 2.4 g/m^2 and these were similar to 1.2 to 2.3 g/m^2 obtained in hoe-weed plots and were significantly less than 21.2 - 21.4 g/m^2 observed in un-weeded plots. At 6 WAS the herbicide treatments had 11.2 -17.6 g/m^2 weed biomass which were significantly less than 70.3 – 73.5 g/m^2 recorded in un-weeded plots. At 8 WAS each of the herbicide treated plots had greater weed biomass each year than what was observed in the respective hoe-weeded plots.

Table 2: Effects of pre-emergence herbicide applications on weed biomass and weed control efficacy in okra plots between four and eight weeks after planting

Treatment	Weed biomass (g/m^2)			Weed control efficacy (%)		
	Weeks After Sowing			Weeks After Sowing		
	4	6	8	4	6	8
2013						
Butachlor at 2.0 kg a.i./ha	1.8b	17.5b	61.6b	91.5 a	75.1 bc	40.1 b
Diuron at 3.6 kg a.i./ha	1.6b	11.2b	54.3b	92.5 a	84.2 a	48.6 b
Atr + Ala at 3.3 kg a.i./ha	1.9b	15.3b	59.1b	91.0 a	78.2a b	44.1 b
Hoe-weeded	1.2b	18.3b	12.2c	94.3 a	71.0 c	90.3 a
Weedy	21.2a	70.3a	102.8a	0.0 b	0.0 d	0.0 c
SE ±	1.63	4.02	4.79	4.43	2.91	5.36
2014						
Butachlor at 2.0 kg a.i./ha	2.4a	17.6b	65.4b	88.8 a	76.0 a	41.0 b
Diuron at 3.6 kg a.i./ha	1.8b	15.5b	63.9b	91.6 a	78.9 a	42.4 b
Atra + Ala at 3.3 kg a.i./ha	2.1b	16.8b	67.0b	90.2 a	77.1 a	39.5 b
Hoe-weeded	2.3b	21.4b	14.4c	89.3 a	70.8 a	87.0 a
Weedy	21.4a	73.5a	110.8a	0.0 b	0.0 b	0.0 c
SE ±	1.27	4.25	5.53	5.91	5.38	2.29

Means within a column followed by the same letter(s) in the same year do not differ significantly at 5% level of probability using LSD.

WAS = Weeks After Sowing

Dia = Diameter, Atr +Ala =Atrazine +Alachlor, Hoe-weeded = Hoe-weeded at 3 and 6 WAS

h) Weed control efficacy

All the chemical weed control treatments had similar outcome at 4 WAS. Weed control efficacy of the pre-emergence herbicides was better than what was recorded in the weedy check at 4, 6 and 8 WAS (Table 2.0).

The response of okra to the pre-emergence application of the herbicides followed the same trend in WCE in the two years.

IV. Discussion

The phytotoxic effects on okra, okra stands survival, number of leaves per plant, stem diameter and shoot biomass in butachlor treated plots were not significantly different from hoe-weeded plots. In assessing the performance of okra in butachlor, diuron and atrazine + alachlor, used at 2.0, 3.6 and 3.3 kg a.i. /ha respectively, diuron significantly ($p < 0.05$) reduced (survival) number of okra seedlings per plot, number of leaves per plant, stem diameter and shoot biomass. Diuron was injurious to the okra plant; the plant showed sensitivity to the pre-emergence application of diuron at the rate of 3.6 kg a.i./ha. Butachlor had no phytotoxic effect on okra plant at the rate of 2.0 kg a.i./ ha. It must have only suppressed weed and not cause any detrimental effect on the crop hence it produced shoot biomass that was similar to that produced by hoe-weeded check. Adigun, *et al.* (2018) reported a successful use of butachlor at 2.0 kg a.i./ha in okra production.

Okra had greater number of leaves per plant, stem height and stem diameter at eight weeks after sowing in butachlor treated plots than in plots treated with diuron and atrazine + alachlor, this is probably beyond the case of competition between surviving weeds and okra for plant growth resources in the environment. At the time of terminating the experiment (eight weeks after sowing) the three herbicides applied pre-emergence had similar average weed control efficacy of 40.1 – 48.6 % in 2013 and 39.5 – 42.7 % in 2014, as well as similar average weed biomass of 54.3 – 61.6 and 63.9 – 67.0 g/m^2 in 2013 and 2014, respectively, yet the average stem height and stem

diameter of okra plants in diuron were significantly less than what was observed in okra grown in butachlor and atrazine + alachlor treated plots. This observation points to an instance of diuron being more phytotoxic to okra than butachlor and atrazine+alaclhor. It is not a case of the quantum of weeds competition with the okra to cause depression in the performance of okra. The injurious effect of pre-emergence herbicides were more expressed in okra plants grown in diuron treated plots than those grown in atrazine + alachlor treated plots. The more injured a plant is, the less it is able to grow vigorously. Okra plants in butachlor treated plots grew vigorously while those grown in the other two grew with lesser vigor, hence the okra biomass was highest in butachlor treated plots followed by the ones grown in atrazine + alachlor and the least are the ones grown in diuron treated plots.

V. Conclusion

The fact that diuron and atrazine + alachlor showed phytotoxicity at 3.6 and 3.3 kg a.i./ha, respectively, does not close the possibility of the use of the two herbicides in okra production. The herbicides at certain lower rates may be less or non-phytotoxic on okra and still sufficiently suppress weed interference for an appreciable growth and yield of okra; such trials are therefore suggested. Butachlor had no phytotoxic effect on okra and had suitable growth performance in the pre-emergence application of the herbicide since it tolerated pre-emergence application of butachlor at 2.0 kg a.i./ha and provided okra establishment, shoot biomass and stem diameter comparable with plots hoe-weeded at three and six weeks after sowing, it also provided a significantly better weed control than weedy check. It is therefore recommended that butachlor should be one of the pre-emergence herbicides considered for weed management in okra production in Asaba in the rain forest ecology of Nigeria.

References Références Referencias

1. Adeyemi OR, Fabunmi TO, Adedeji VO, Adigun JA. 2014. Effects of time of weed removal and cropping system on weed control and crop performance in okra/Amaranthus Intercrop. American Journal of Experimental Agriculture, 4(12), 1697-1707. doi.org/10.9734/ajea/2014/10232.
2. Adigun JA, Daramola OS, Adeyemi OR, Ogungbesan AO, Olorunmaiye PM, Osipitan OA. 2018. Impact of Nitrogen Levels and Weed Control Methods on Growth and Yield of Okra (*Abelmoschus esculentus* (L.) Moench) in the Nigerian Forest-Savanna Transition Zone. Journal of Experimental Agriculture International 20(2), 1-11.
3. Dittmar PJ, Stall WM. 2019. Weed Management in Okra, Document is HS192, one of a series of the Horticultural Sciences Department, UF/IFAS Extension. Original publication was dated March (1999). Retrieved March 5, 2019 from EDIS website https://edis.ifas.ufl.edu/wg032
4. Konlan SK, Opoku-Ameyaw FK, Oppong J Ackornoh, Dorgbadji R. 2016. Crop and Weed Response to Diuron in the Rain Forest Zone of Ghana. Asian Journal of Agricultural Research 10, 56-64.
5. Little TM, Hills FJ. 1978. Agricultural experimentation: design and analysis. New York: John Wiley and Sons, pp. 368.
6. NACWC (National Advisory Committee on Weed Control). 1994. Weed Control Recommendations for Nigeria. Series No. 3. Ibadan. The Department of Agriculture, Federal Ministry of Agriculture, pp. 111.
7. Obiazi CC, Tijani-Eniola H, Olaniyi OW. 2020. Field evaluation of pre-emergence application of selected herbicides for okra tolerance and growth in Asaba, Nigeria. Asian Journal of Agriculture and Rural Development, 10(1), 149-159.
8. Prachand S., Kalhapure A, Kubde, KJ. 2015. Weed management in soybean with pre- and post-emergence herbicides. Indian Journal of Weed Science, 47(2), 163–165.
9. Syngenta.2017. Apron Star 42WS. Last updated: 08.03.2017. Downloaded on the 18th June 2020. https://www.syngenta.co.ke/product/crop-protection/seed-care/apron-star-42ws

Global Journals Guidelines Handbook 2021

www.GlobalJournals.org

Memberships

Fellows/Associates of Science Frontier Research Council

FSFRC/ASFRC Memberships

Introduction

FSFRC/ASFRC is the most prestigious membership of Global Journals accredited by Open Association of Research Society, U.S.A (OARS). The credentials of Fellow and Associate designations signify that the researcher has gained the knowledge of the fundamental and high-level concepts, and is a subject matter expert, proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice. The credentials are designated only to the researchers, scientists, and professionals that have been selected by a rigorous process by our Editorial Board and Management Board.

Associates of FSFRC/ASFRC are scientists and researchers from around the world are working on projects/researches that have huge potentials. Members support Global Journals' mission to advance technology for humanity and the profession.

FSFRC

Fellow of Science Frontier Research Council

FELLOW OF SCIENCE FRONTIER RESEARCH COUNCIL is the most prestigious membership of Global Journals. It is an award and membership granted to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Fellows are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Fellow Members.

Benefit

To the institution

Get letter of appreciation

Global Journals sends a letter of appreciation of author to the Dean or CEO of the University or Company of which author is a part, signed by editor in chief or chief author.

Exclusive Network

Get access to a closed network

A FSFRC member gets access to a closed network of Tier 1 researchers and scientists with direct communication channel through our website. Fellows can reach out to other members or researchers directly. They should also be open to reaching out by other.

Career | Credibility | Exclusive | Reputation

Certificate

Receive a print ed copy of a certificate

Fellows receive a printed copy of a certificate signed by our Chief Author that may be used for academic purposes and a personal recommendation letter to the dean of member's university.

Career | Credibility | Exclusive | Reputation

Designation

Get honored title of membership

Fellows can use the honored title of membership. The “FSFRC” is an honored title which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., FSFRC or William Walldroff, M.S., FSFRC.

Career | Credibility | Exclusive | Reputation

Recognition on the Platform

Better visibility and citation

All the Fellow members of FSFRC get a badge of "Leading Member of Global Journals" on the Research Community that distinguishes them from others. Additionally, the profile is also partially maintained by our team for better visibility and citation. All fellows get a dedicated page on the website with their biography.

Career | Credibility | Reputation

Future Work

Get discounts on the future publications

Fellows receive discounts on future publications with Global Journals up to 60%. Through our recommendation programs, members also receive discounts on publications made with OARS affiliated organizations.

Career | Financial

GJ Internal Account

Unlimited forward of Emails

Fellows get secure and fast GJ work emails with unlimited forward of emails that they may use them as their primary email. For example,
john [AT] globaljournals [DOT] org.

Career | Credibility | Reputation

Premium Tools

Access to all the premium tools

To take future researches to the zenith, fellows and associates receive access to all the premium tools that Global Journals have to offer along with the partnership with some of the best marketing leading tools out there.

Financial

Conferences & Events

Organize seminar/conference

Fellows are authorized to organize symposium/seminar/conference on behalf of Global Journal Incorporation (USA). They can also participate in the same organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent. Additionally, they get free research conferences (and others) alerts.

Career | Credibility | Financial

Early Invitations

Early invitations to all the symposiums, seminars, conferences

All fellows receive the early invitations to all the symposiums, seminars, conferences and webinars hosted by Global Journals in their subject.

Exclusive

Publishing Articles & Books

Earn 60% of sales proceeds

Fellows can publish articles (limited) without any fees. Also, they can earn up to 60% of sales proceeds from the sale of reference/review books/literature/ publishing of research paper. The FSFRC member can decide its price and we can help in making the right decision.

Exclusive | Financial

Reviewers

Get a remuneration of 15% of author fees

Fellow members are eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get a remuneration of 15% of author fees, taken from the author of a respective paper.

Financial

Access to Editorial Board

Become a member of the Editorial Board

Fellows may join as a member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. Additionally, Fellows get a chance to nominate other members for Editorial Board.

Career | Credibility | Exclusive | Reputation

And Much More

Get access to scientific museums and observatories across the globe

All members get access to 5 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 10 GB free secure cloud access for storing research files.

ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL

ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL is the membership of Global Journals awarded to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Associate membership can later be promoted to Fellow Membership. Associates are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Associate Members.

To the institution

Get letter of appreciation

Global Journals sends a letter of appreciation of author to the Dean or CEO of the University or Company of which author is a part, signed by editor in chief or chief author.

Exclusive Network

Get access to a closed network

A ASFRC member gets access to a closed network of Tier 1 researchers and scientists with direct communication channel through our website. Associates can reach out to other members or researchers directly. They should also be open to reaching out by other.

Career | Credibility | Exclusive | Reputation

Certificate

Receive a print ed copy of a certificate

Associates receive a printed copy of a certificate signed by our Chief Author that may be used for academic purposes and a personal recommendation letter to the dean of member's university.

Career | Credibility | Exclusive | Reputation

Designation

Get honored title of membership

Associates can use the honored title of membership. The “ASFRC” is an honored title which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., ASFRC or William Walldroff, M.S., ASFRC.

Career | Credibility | Exclusive | Reputation

Recognition on the Platform

Better visibility and citation

All the Associate members of ASFRC get a badge of "Leading Member of Global Journals" on the Research Community that distinguishes them from others. Additionally, the profile is also partially maintained by our team for better visibility and citation. All associates get a dedicated page on the website with their biography.

Career | Credibility | Reputation

Future Work

Get discounts on the future publications

Associates receive discounts on the future publications with Global Journals up to 60%. Through our recommendation programs, members also receive discounts on publications made with OARS affiliated organizations.

Career | Financial

GJ Internal Account

Unlimited forward of Emails

Associates get secure and fast GJ work emails with unlimited forward of emails that they may use them as their primary email. For example,
john [AT] globaljournals [DOT] org.

Career | Credibility | Reputation

Premium Tools

Access to all the premium tools

To take future researches to the zenith, fellows receive access to almost all the premium tools that Global Journals have to offer along with the partnership with some of the best marketing leading tools out there.

Financial

Conferences & Events

Organize seminar/conference

Associates are authorized to organize symposium/seminar/conference on behalf of Global Journal Incorporation (USA). They can also participate in the same organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent. Additionally, they get free research conferences (and others) alerts.

Career | Credibility | Financial

Early Invitations

Early invitations to all the symposiums, seminars, conferences

All associates receive the early invitations to all the symposiums, seminars, conferences and webinars hosted by Global Journals in their subject.

Exclusive

Publishing Articles & Books

Earn 30-40% of sales proceeds

Associates can publish articles (limited) without any fees. Also, they can earn up to 30-40% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.

Exclusive | Financial

Reviewers

Get a remuneration of 15% of author fees

Associate members are eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get a remuneration of 15% of author fees, taken from the author of a respective paper.

Financial

And Much More

Get access to scientific museums and observatories across the globe

All members get access to 2 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 5 GB free secure cloud access for storing research files.

Associate	Fellow	Research Group	Basic
$4800 **lifetime designation**	$6800 **lifetime designation**	$12500.00 **organizational**	APC **per article**
Certificate, LoR and Momento **2** discounted publishing/year **Gradation** of Research **10** research contacts/day **1 GB** Cloud Storage **GJ** Community Access	**Certificate,** LoR and Momento **Unlimited** discounted publishing/year **Gradation** of Research **Unlimited** research contacts/day **5 GB** Cloud Storage **Online Presense** Assistance **GJ** Community Access	**Certificates,** LoRs and Momentos **Unlimited** free publishing/year **Gradation** of Research **Unlimited** research contacts/day **Unlimited** Cloud Storage **Online Presense** Assistance **GJ** Community Access	**GJ** Community Access

Preferred Author Guidelines

We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

Before and during Submission

Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct,* along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

Declaration of Conflicts of Interest

It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

Policy on Plagiarism

Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

- Words (language)
- Ideas
- Findings
- Writings
- Diagrams
- Graphs
- Illustrations
- Lectures

- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

Authorship Policies

Global Journals follows the definition of authorship set up by the Open Association of Research Society, USA. According to its guidelines, authorship criteria must be based on:

1. Substantial contributions to the conception and acquisition of data, analysis, and interpretation of findings.
2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

Copyright

During submission of the manuscript, the author is confirming an exclusive license agreement with Global Journals which gives Global Journals the authority to reproduce, reuse, and republish authors' research. We also believe in flexible copyright terms where copyright may remain with authors/employers/institutions as well. Contact your editor after acceptance to choose your copyright policy. You may follow this form for copyright transfers.

Appealing Decisions

Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

Declaration of funding sources

Global Journals is in partnership with various universities, laboratories, and other institutions worldwide in the research domain. Authors are requested to disclose their source of funding during every stage of their research, such as making analysis, performing laboratory operations, computing data, and using institutional resources, from writing an article to its submission. This will also help authors to get reimbursements by requesting an open access publication letter from Global Journals and submitting to the respective funding source.

Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for Writing a Good Quality Science Frontier Research Paper

Techniques for writing a good quality Science Frontier Research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

INDEX

Global Journal of Science Frontier Research

Visit us on the Web at www.GlobalJournals.org | www.JournalofScience.org
or email us at helpdesk@globaljournals.org

ISSN 9755896