Nig. J. Anim. Prod. 2022, 49(2):266-276.https://doi.org/10.51791/njap.v49i2.3488 *Nigerian Journal of Animal Production*

Techniques of sown pasture establishment and management in Sudan Savanna zone Nigeria: Technical report

Garba, M. G., Gaddafi, S. and Idowu, W.

[1]*Department of Animal Science, Federal University Dutsin-Ma, Katsina State, Nigeria*

Corresponding author: alghazali8067@gmail.com; 08034655789

Abstract

Increasing demands for livestock products in Nigeria have greatly offered opportunities for farmers to intensify their production systems. However, there is an erratic supply of these products, especially during the dry season due to poor quality feed resources and management Therefore, the aim of this study was to highlight simple techniques involved in sown pasture establishment and management in Sudan savannah ecological zone. From the collective technical activities carried out, the series of technical activities for pasture establishment and management were site selection, soil testing and correcting soil nutrient deficiencies, seedbed preparation, pasture species selection, timing planting date, seed dressing and treatment, seeding methods, weed control, fertilizer application, pasture disease and pest control, grazing management, forage and seed harvesting techniques and forage conservation. Considering dwindling feed production for livestock while demand is on the significant increases, there is a need for pasture scientist and other livestock researchers to intensify efforts to fully explore modern-strategic approaches for pasture establishment and management through integration of cheapest and commonest ways that requires less technical labour skills, land and other input.

Keywords: Pasture, establishment and management

Techniques d'établissement de pâturage semé et de gestion au Soudan Savanna Zone Nigeria: Rapport technique

Résumé

Les demandes croissantes pour les produits de bétail au Nigéria ont grandement offert des possibilités d'intensifier leurs systèmes de production. Cependant, il existe une offre erratique de ces produits, en particulier pendant la saison sèche due à une mauvaise qualité des ressources et une mauvaise gestion, l'objectif de cette étude était de mettre en évidence des techniques simples impliquées dans l'établissement et la gestion des pâturages semés dans la zone écologique du Soudan Savannah. Des activités techniques collectives réalisées, la série d'activités techniques pour l'établissement et la gestion des pâturages était la sélection de chantiers, les tests de sol et la correction des carences de nutriment de sol, la préparation des semences, la sélection des espèces de pâturage, la date de la plantation de calendrier, la vinaigrette et le traitement, des méthodes d'ensemencement, des mauvaises herbes Contrôle, application d'engrais, pâturage et contrôle des parasites, de gestion des pâturages, des techniques de pêche des fourrages et des semences et de la conservation des fourrages. Compte tenu de la production d'aliments en diminution du bétail tandis que la demande repose sur les augmentations importantes, il est nécessaire de renforcer les chercheurs scientifiques et autres chercheurs d'élevage pour intensifier les efforts visant à explorer pleinement les approches stratégiques modernes pour l'établissement des pâturages et la gestion grâce à l'intégration des moyens les moins chers et les plus communs

qui nécessitent moins cher compétences techniques du travail, des terres et autres entrées.

Mots-clés: pâturage, établissement et gestion

Introduction

Increasing demands for livestock products in Nigeria have greatly offered opportunities for farmers to intensify their production systems. However, there is an erratic supply of these products, especially during the dry season due to poor quality feed resources and management (Roothaert *et al.,* 2005). In order to overcome these problems, several researchers are of the opinion that intensive forage management systems exploiting land, labour and water resources coupled with utilization of suitable forage species need to be developed for livestock holders in developing countries (Mirandi *et al.,* 2003; Millar and Phatakoun, 2008). Nigeria has about 92.4 million hectares of land areas which about 44% are under permanent pastures. It is estimated that only about 3% of over 101 million domestic ruminants in Nigeria are reared on improved pastures; the remaining 97% are raised on low nutrient native pastures and farmlands (Shiawoya and Tsado, 2011). The poor performance of ruminant in Nigeria has been attributed to large dependence on natural pastures which on several occasions has been reported to be low both in quality and quantity of nutrients composition when compared to those in the temperate region (Tian *et al.,* 2000). Muinga *et al.* (2007) reported that tropical grasses are typically known to have low crude protein that cannot solely sustain ruminant animals throughout the year. Low quality forage and fodder crop species, inadequate input supply, poor land preparation, increase of human activities and inadequate forage and fodder scientists will be a major problems facing forage and fodder crop production in Nigeria. However, proper forage establishment, development of more grazing reserves, use of biotechnology, proper forage and fodder conservation and other management measures will be key step in having a profitable pasture in Nigeria (Gaddafi *et al.,* 2019). The objective of this study is to provide insight and technical details involves in pasture establishment.

Materials and methods

Study area

This study was carried out at Pasture Unit of Livestock Teaching and Research Farm, Department of Animal Science, Federal University Dutsin-ma, Katsina state. The site lies between latitude 12°27'18' North and 7°29'29' East and 605 meters above sea level with an annual average rainfall of 700mm and situated in the Sudan Savannah ecological zone of Nigeria.

Materials used

Photographs were taken from pasture unit of Livestock Teaching and Research Farm, Department of Animal Science, Federal University Dutsin-Ma. All photographs were taken using a Nokia phone version 2.1 model TA-1080 digital camera with Camera firmware version 0309 and 16 mp camera lens. The routine activities and various pasture photographs presented here were selected to provide visual insight into some activities that took place in the unit from 2018 to 2021. Other than image resizing, the photographs have not been substantially modified.

Techniques involves in sown pasture establishment

Site selection: The acquisition of a functional and effective meteorological station is absolutely essential in pasture production (Akinola, 2019), these included meteorological indices, adequate annual precipitation, adequate soil depth to provide sufficient water-holding capacity for productive plant growth, appropriate soil texture for root development and

growth and freedom from rocks, waterlogging and excess salt accumulation.

Soil testing and correcting soil nutrient deficiencies: The productivity of forage in terms of quantity and quality has been attached to soil fertility. Tropical soils have been known for low fertility which is basically responsible for low forage productivity. Research has shown that it can be corrected by the application of inorganic fertilizers (Dele, 2008). Often six months before the actual pasture establishment in the unit, soil fertility need to be adjusted before seeding (Gaddafi *et al.,* 2019).

Seedbed preparation/Land preparation: The most successful pasture establishment method is to clear the land and prepare seed bed. Land preparation involves clearing, pulverizing the soil and cultivation. During clearing trees, shrubs and saplings are pulled down and windrowed. Roots and stem are then cut. These operations can be carried out using caterpillars, cutlass or machete, digger and axes. Land clearing is followed by mechanical ploughing or/in chiseling to break hard soils to lift up stones and roots. Big and small hoes can be used in manual operations (picture below) and ploughing should be done when rains have been established. The area ploughed is therefore disk harrowed when it is ready to plant. In some cases it is usually necessary to plough and harrow only once but single ploughing and double harrowing gives better prepared land and preferable for small seeded legumes and grasses. For small scale pasture legume establishment the land can be prepared by the use of animal traction or confining animals between April and May on the site to trample the soil (Muhammad and Abubakar, 2002).

Plate 1: Land preparation

Species selection: Right species of grasses and legumes will source and procured from National Animal Production Research Institute (NAPRI) Shika-Zaria and other reputable farms. Grasses and legumes will be selected and planted based on soil type, soil composition and seasonality (Annual or perennial).

Date of planting: Planting date is a critical factor in pasture establishment particularly in tropical/subtropical areas with unimodal, low rainfall regimes. For instance, in the Sudan savannah ecological zones rain falls from mid-June and ends early October. This suggests that farmer should have a proper timing for sowing their grasses and legumes that will suits this low rainfall duration for effective pastures development.

Seed dressing and treatment: Seed is necessary for establishing new pasture, over sowing existing or native pasture and undoubtedly for renovating deteriorating/degraded grazing lands. It must be clearly stated that a grazed pasture will deteriorate with time even if well managed and therefore it will need to be reseeded (Akinola, 2019). Most of the grass species do not require any pre-sowing seed treatments. Percentage and rate of germination of a number of legumes is however low unless the seeds are treated before seeding. This is due to hardiness or post ripening dormancy. There is need to scarify such seed in order to increase their rate of germination. A common and cheap method involves the immersion of the seed in warm water at approximately 70ºC for a specific time (5 to 15 minutes) depend on the seed type because the temperature and the time limit vary from one species to the other. Other methods of scarifying seeds are: mechanical –using abrasive means and chemical –using concentrated sulphuric acid for a specific time, followed by thorough washing with water. Seeds treated with hot water or chemical should be dried briefly in the sun before sowing (Muhammad and Abubakar, 2002).

Plates 2 and 3: Pasture seeds treatment

Seeding methods: Drilling, cultipacking/transplanting and broadcasting seeding are three sowing methods conveniently used for pasture establishment depending on the forage material, size of the land area and resources of the farmer. Pasture seed can be sown with a combined seed and fertilizer drill. This has the benefit of placing the seed and fertilizer at different depths. Seeds are also placed at the right depth (1-2cm), all these ensure good germination and establishment. An ordinary seed drill calibrated to suit the size of the seed being planted may be used. In this case the seed and the fertilizer are mixed. Pasture seed for sowing on hill should be limited to 3-4 stands/hill, established using 30 cm intra-row spacing and 75 cm inter-row spacing or 50cm x 50cm spacing for both inter- and intra- row spacing with depth of 1.5 to 2.5cm (half the length of smallest finger). This ensures early ground cover and high fodder production (Muhammad and Abubakar, 2002). Drilling methods is carried out based on the type of seeds and seedbed to ensure good soil-to-seed contact, seed germination, and timely emergence (Gaddafi *et al.,* 2019). Broadcasting is employed when a seed drill is not available or when the ground is soft to allow the use of machinery. In this condition higher seed rates should be used as seeds may be lost through erosion and harvesting by ants. When seeds are broadcast light harrowing using tree branches will result in better establishment. In order to obtain even distribution, seed may be mixed with dry sand or super phosphate fertilizer in a proportion of 1 part by volume of dry seed to 3 parts by volume of sand/fertilizer. Transplanting are usually uprooted a day or two ahead of planting. The leaves and stems from the shoot of material should be trimmed to reduce water loss. The material is preferably transported during the cool hours of evening or night, rested and planted as early as possible, preferably on the day of arrival at the planting site. Transplanting is better done in July to August in Sudan savannah zone, by two operators. One sorting and distributing the material firm in to the soil/hole and consolidating the soil around the seedling to ensure that pockets of air are completely excluded from the root zones. Foster. (1961) and de Leeuw (1973) described methods of pasture establishment without land preparation which include: aerial seeding into natural grassland, usually after burning or defoliation with herbicides (de Leeuw, 1973); and broadcasting seeds into unprepared soil, and distribution of seeds through the grazing of faster (Foster, 1961). Pasture establishment using the above techniques are subject to severe competition from existing vegetation and often produce little forage and last for a short time.

Weed control: Weed control to avoid extremely competition with newly emerged forage seedlings. Weed emergence are inevitable in newly seeded pasture. Weeds compete with pasture species for nutrients, water, and light. This consequently affects the vigour of the emerging seedlings and reduced forage cover. Pasture established on newly cleared lands are soon invaded by regrowth from stumps and roots of plant species that occur in the area. Weed control has to be carried out regularly to avoid weeds competition for water, nutrients, and sunlight with pasture. Pasture established in a specified spacing, tractor drawn rotary weeders, ox drawn cultivators, manual weeding with hoes and the rogueing of off types could be used to control weeds. It is recommended that the newly established pasture be weeded twice, atone month and 2-3 months after seeding.

Established grass and legume pasture

Fertilizer application: The application of fertilizer assures effective pasture establishment. Depend on the soil fertility, pasture grass species respond clearly to nitrogen application. Nitrogen increases the yield of forage grasses by 50-60% (Muhammad and Abubakar, 2004)

Pasture disease and pest control: Various diseases and pest do occur in pasture production. The legumes are more susceptible to disease and pest than the grasses. Control measures for pest and diseases have usually include plant and seed treatment with agricultural chemicals, good hygiene, quarantine, and the use of cultural methods such as crop rotation, removal of crop residues containing insects or diseases and a series of cultures that are tolerant or resistant to pest and disease attacks.

Plate 4: Pest control in pasture

Grazing management: Grazing management involves monitoring animals how long animals should stay on one area and how long they should stay off it, how many animals should graze together and what other activities should be integrated with grazing (Spedding, 1976). Two grazing management systems are common, the continuous which involves grazing animals in a confined simple enclosed pasture area for the entire growing season (Booysen, 1975) and some forms of rotational grazing with sub-division of the pasture into a number of enclosures (fences).

Plate 5: Fence (paddock)

Forage/seed harvesting: It is extremely difficult to determine the right time for harvesting forage seed due to poor asynchronisation of flowering and rapid shedding. Generally, most pasture seeds are harvested when the moisture of the seed is about 10-20% especially legumes. The length of harvest period must be short in order to recover a higher seed yield. Pasture seed can be harvested using the following methods: Hand collection- which involves rubbing and shaking of the heads into a container or by picking the ripe pods of legumes. This method gives high seed yield of excellent quality. Cut, dry and thresh method- the pasture or forage crop is cut by using sickles, knives, a mower or forage harvester. This method is popular for *desmodium, chloris gayana* and *panicums* (Amodu, 2002). Cut, sweep or suck method- this technique is useful for *stylosanthes hamate, S. humilis,* and *S. guianensis.* Species which are swept up from the ground preferably are grown on soil which can be readily separated from the seed by sieving.

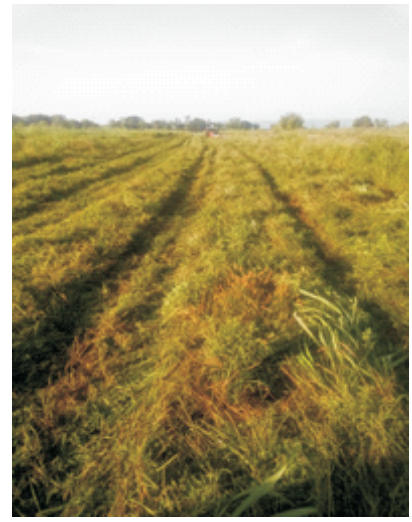

Plate 6: Mechanical harvesting

Conservation: Silage and hay are commonest methods of preserving pasture. Silages and haylages are fermented forages stored under anaerobic condition in a silo. Silos are designated so that anaerobic conditions prevail during the storage of high moisture feedstuffs. Hay is the aerial part of forage crops which is harvested during the growing period and preserved by drying for later use in animal feeding. The primary objective of hay making is to lower the moisture content of the forage. This occurs when the moisture reduced to 15-20%. The simple method of forage preservation is hay primarily because it is relatively easy to handle and stored.

Plate 7: Conservation

Table 1: Naturally occurring pasture species identified in Livestock Teaching and Research Farm, FUDMA

Botanical Name	Common Name	Hausa Name
Amaranthus spinosus	Spiny amaranth	Zarangade
Axonopus compressus	Carpet grass	-
Bororia radiate	Ant wheat	Alkamar turuwa
Chloris gayanus	Finger grass	
Cencrus biflorus	Bargrass	Karangiya
Cencrus prieurii	Spinless	Karangiya marar kaya
Commelina banghalensis	Banghal day flower	Balasaya
Cyperus rotundus	-	Ayaaya
Digiteria horizantalis	Crab grass	Harkiya
Eragrostis tremula	Love grass	Burburwa
Euphorbia convolvuloides	Fula Pulear	Nonon Kurciya
Ipomoea kotschyana	Morning glory	Takalmin kwado
Pennisetum pedicellatum	Hairy fountain grass	Kyasuwa
Paspalum scrobiculatum	-	Gudagude
Strigaher monthica	-	Kudiji

Source: Field survey, 2020

Table 2: Recommended grasses and legume species, seed rates and their mode of propagation in Sudan savannah ecological zone

Botanical name	**Common Name**	**Seed rate (kg/ha)**	**Mode of propagation**
Andropogon gayanus	Gamba grass	50-60	Seeding and vegetative transplanting
Brachiaria brizantha	Signal grass	10-15	Seeding and vegetative transplanting
Brachiaria decumbens	Signal grass	10-15	Seeding and vegetative transplanting
Cenchrus biflorus	Bargrass	10-15	Seeding
Cenchrus ciliaris	Buffel grass	10-15	Seeding
Cenchrus prieurii	Spinless karangiya	15-20	Seeding
Digitaria smutsii	Wooly finger grass	-	Vegetative transplanting
Eragrostis tremula	Love grass	5-10	Seeding
Panicum maximum	Guinea grass	5-10	Seeding and vegetative transplanting
Pennisetum pedicellatum	Hairy fountain grass	15-20	Seeding
Pennistum purpureum	Elephant grass	-	Vegetative transplanting
Veteveria nigritana	Vetiver grass	-	Vegetative transplanting
Alysicarpus spp	Gadagi	5-10	Seeding
Arachis hypogaea	Groundnut	20-30	Seeding
Crotalaria macrocalyx	Gujjiyar awaki	5-10	Seeding
Mucuna pruriens	Mucuna	20-30	Seeding
Cajanus cajan	Pigeon pea	20-30	Seeding
Lablab purpureus	Lablab	10-25	Seeding
Stylosanthes fructicosa	Shrubby stylo	5-8	Seeding
Vigna spp	Cowpea	25-50	Seeding

Source: Kalla, 1999.

Conclusion

Considering dwindling feed production for livestock while demand is on the significant increases, there is need for pasture scientists and other livestock researchers to intensify efforts to fully explore modern-strategic approaches for pasture establishment and management through integration of cheapest and commonest ways that requires less technical labour skills, land and other inputs.

References

Akinola, J. O. 2019. The needs for a grassland research institute of Nigeria. *Proceedings at the 3rd Biennial conference of the society for grassland and development in Nigeria Held at the National Animal Production Research Institute, A.B.U-Shika, Zaria 3rd – 6th Nov. 2019*, 10 – 11.

Amodu, J. T. 2002. Pasture seed production, Processing and storage. *Small Ruminant Production Training Workshop held at National Animal Production Research Institute, Ahmadu Bello University, Shika-Zaria 13th – 18th January, 2002,* pp49-54.

Booysen, P. 1975. Economic optimization of stocking rate and grazing management. *Proceedings of 6th Meeting European Grassland Federation Madrid,* p186.

de Leeuw, P. N. and Brinkman, W. L. 1973. Pasture and rangeland improvement in the northern guinea savannan and sudan savannah zones of Nigeria. Proceeding of International Symposium on Animal Production in the tropics Held at Ibadan.

Dele, P. A. 2008. Effect of plot management and fertilizer treatments on the growth, biomass yield and seed quality of two guinea grass varieties. M.Sc Agric Dissertation, Department of Pasture and Range Management, University of Agriculture, Abeokuta, 84pp.

Foster, W. H. 1961. Notes on the establishment of legume in rangeland in northern Nigeria. *Emperical Journal of Experimental Agriculture,* 29, 319.

Gaddafi, S., Garba, M. G., Ajibola, O. O., Alkali, M. M. and Dabai, M. I. 2019. A Photo- Essay on pasture establishment at Livestock Teaching and Research Farm, Federal University Dutsin-Ma, Katsina State. *Proceedings at the 3rd Biennial Conference of the Society for Grassland and Development in Nigeria Held at the National Animal Production Research Institute, A.B.U-Shika, Zaria,* 3rd-6th Nov., 2019. Pp 44-49.

Kallah, M. S. 1999. Varietal maintenance in pasture seed production. In A. Aliyu, A. Joshua and P. Oyekan (eds). Seed technology. *A manual for varietal maintenance and breeder and foundation seed production,* 184-195.

Miranda, C. H. B., Vieira, A. and Cadiseh, G. 2003. Determinacao da fixacao biologica de nitrogenio no amendoin forrageiro (Arachis spp.) por intermedio da abundancia natural de 15N. *Revista Brasileira de Zooteonia,* 32(6):1859-1865.

Muhammad, I. R. and Abubakar, S. A. 2002. Establishement and Management of sown pastures. *Small Ruminant Production Training Workshop held at National Animal Production Research Institute, Ahmadu Bello University, Shika-Zaria 13th – 18th January,* 2002, pp11-17.

Muhammad, I. R. and Abubakar, S. A. 2004. Establishment and management of sown pasture. In: *Proceeding of Training Workshop on Pasture and Range Management in Nigeria. Held at the National Animal Production Research Institute, Ahmadu Bello University, Zaria*. 10-14th October, 2004.pp23-25.

Muinga, R.W., Mureithi, J.G., Juma, H. and Saha, H. M. 2007. The effect of supplementing Napier grass or maize stover basal diet with either Glirida, Clitoria or mucuna on manure quality and quantity of jersey cows. *Tropical and Sub tropical Agroecosytems,* 7(3):157-63.

Roothaert, R. L., Binh, L. H., Magbo, E. D., Yen, V. H., Sanguinhon, J. 2005. Participatory forage technology development in southeast Asia. In: yimegnuhal, A., Degefa, T. (eds.). Participatory innovation and Research: Lessons for Livestock development: *Proceedings of the 12th annual conference of the Ethiopian society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, August 12 – 14, 2014. Vol.1 Plenary session.* 21-30.

Tian, G., Hauser, S., Koutika, L. S., Ishida, F. and Chianu, J. N. 2000. Presasia cover crop fallow system benefits and applicability. Minneapolis, USA, 5-9 Nov. pp 137-155, Agricultural Science, 3:4-6.

Received: 24th November, 2021
Accepted: 26th February, 2022