



## Full Length Research Paper

# Effects of Different Mulching Materials on the Growth Performance of Okra in Maiduguri

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### Abstract

A study was carried out in the demonstration farm of Ramat Polytechnic Maiduguri to investigate the effects of different mulching materials on the growth performance of okra (*Abelmoschus esculentus* L.). The treatment include plastic mulch, sorghum straw mulch, sawdust mulch and control (No mulch) which were laid out in a randomized complete block design (RCBD) and replicated three times. The results show that growth parameter like plant height, weed count and flower bud count has no significant difference between the treatments but all treatment has some superiority to the control. It is evident from this work soil moisture retention was higher with the use of sorghum straw and polythene mulch and soil temperature was lowest in sorghum straw mulch.

**Keywords:** Mulching materials, sawdust mulch, okra

## INTRODUCTION

Okra (*Abelmoschus esculentus* L.) belong to the family of malvaceae, it is an important vegetable crop in Nigeria, and is grown extensively, throughout the country as summer crop. The young tender pods are used fresh or as dry powder in soup and stew. Okra grows and yield better during the summer, whereas the winter grow plant are usually retarded in growth, late in maturity and produce pods that are generally curved and okra purs El Hassan, (1978). Summer crops like okra purslane and sew's mallow, give their best yield and quantity when planted on the southern side of the ridge during winter, because of the higher soil temperature on this side El Hassan, (1984).

The high economic value of okra crops justified the modification to the producers, improved quality and/or extend the growing season, producer of okra crops often used different mulching types to suppress weed or conversation of moisture near the root of the crop. Mulches affect not only the soil environment. However, the mulches, changes the plants environment depending on the properties of the mulches and the level of the physical contact between the mulches materials and the soil.

The use of sawdust, polythene, straw mulches for dry season vegetables production in the research farm,

increase the soil temperature, conserves soil moisture. In this manners its play a positive role in the water conservation. The objective of the research work is to determine the effects of different mulching materials on the growth of okra. Other objective is:

- To know which mulching material will have the highest growth performance.

### Origin and Geographic Distribution

Okra plant or lady's finger was previously included in the genus moicus. Later it was designated to *Abelmoschus*, which is distinguished from the genus Hibicus Aladele et al, (2008). *Abelmoschus* was subsequently proposed to be raised to the rank of distinct genus by Medilues in 1787. Okra originated somewhere around the Ethiopia and was cultivated by the ancient Egyptians by the 12th century BC. Its cultivated spread throughout Middle East and North Africa Tindall 1983, Lamount (1999). Okra is grown in many parts of the world, especially in tropical and subtropical countries Arapitses, 2007, Saiffellah and Rabbani, (2009). This crop can be grown a large commercial farm or as a garden crop Rubatzky and Yamaguchi, (1997). Okra crop can be grown commercially in many countries such as India, Japan,

Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Myanmar, Malaysia, Thailand, Brazil, Ethiopia, Cyprus and in the Southern United States. Purseylove, 1887). Benjawan et al., 2007, Ghurishi, (2007). Okra is found all around the world from equatorial areas to Mediterians Sea as may be seen from the geographical distribution of cultivation and wild species cultivated and wild species of okra clearly showed overlapping in South East Asia, which is considered as the center of diversity. The spread of the other species is the result of their introduction to Africa and America Qhiereshi (2007), Aladeye et al., (2008).

There are two hypotheses concerning the geographical origin of *A. esculentus*. Some scientist argue that one putative ancestors (*A. tuberculatus*) is native from Northern India, suggesting that the species originated from this geographical area on the bases of ancient cultivation in East Africa and the presence of the other putative ancestor (*A. ficulneous*) other suggest that the area of domestication is Ethiopia or North Egypt, but no definite proof is available today Department of Biotechnology, (2007). *Abelmoschus* species occurs in the world including as *A. moschus*, *A. manihot*, *A. esculentus*, *A. tuberculatus*, *A. ficulneous*, *A. Crinilus*, and *A. angulosus* Chorrier (1984). The three cultivation species which are sometimes found in all tropical, subtropical and warm temperature regions of the world.

The species *A. Moschus* has a wild geographical distribution in India, Southern China, Indonesia, Pappia, New Guinea, Australia, Central and West Africa. The species *A. manihot* subs P. Manihot is cultivated mainly in the East Asia, but also in the India sub-continent and Northern Australia. It is less frequently found in America and tropical Africa Cheva Lier (1940).

The wild species *A. tuberculatus* related to *A. esculentus*, is endemic to the medium altitudes hilly areas in India IBPGR, (1991). The wild species *A. ficulneous* is found in a vast geographical area stretching from Africa to Asia and Australia. It flourishes in tropical's area of low altitude with a long dry season, i.e. desert regions of Sahalian Africa (Niger) Madagasca, East Africa, India, Indonesia, Malaysia and Northern Australia Lamount (1999).

The two wild species *A. crinitus* and *A. angulosus* are exclusively Asian origin. There are differentiated by their ecology. *A. crinitus* grows at low altitude in regions with a marked dry season, being (China, India, Pakistan and Philippines). *A. angulosus* grows at altitude between 750 and 2000m in Pakistan, India, Sri Lanka, Indonesia Charrier (1984) and IBPGR (1991).

### Ecology and Seasonal Growth

Okra need temperature above 20°C normal growth and development Lamount, (1999), Abel El Kader et al. (2010). Germination percentage and speed of emergence are optimum at 30°C - 35°C Akande et al., (2003). Flower

initiation and flowering are delayed with an increase in temperature and number (positive correlation between temperature and number of vegetables nodes) Lamount, (1999), Abel El Kader et al., (2010). *Abelmoschus* species is a short-day plant but its wide geographical distribution (Up to latitude of 35°C - 40°C) indicate that cultivars differ markedly in sensitivity. Flower initiation and flower are hardly affected by day length in popular subtropical cultivars. Most tropical cultivars show quantitative short day responses, but qualitative responses also occur. The shortest critical day length reported is 12:30 hours. The explains why flowering of local cultivars of common okra is only qualitative affected by day length in the coasted areas of the latitude (10°N) one can occasionally observe very tall non-flowering plants of common okra due to a qualitative response. Okra tolerates poor soil, but prefers well-drained sandy loam, with the pH 6-7 and high content of organic matter. Okra requires a moderate rainfall of 80-100cm in well distributed to produce its young edibles fruits over a relatives long period. An average temperature of 200 - 30°C is considered optimum for grazing, flowering and fruiting Akinyele and Temikotan, (2007), Dada and Fayinminnu, (2010).

### Integrated Management

Commercial okra growers usually practice sole cropping, and prefer the early, homogeneous, introduced cultivars. In traditional agriculture, farmers growth their okra landraces in home gardens or in fields with other food crops Rashid et al. (2002). In West and Central Africa the landraces often consist of a mixture of *Abelmoschus esculentus* and *Abelmoschus caillei*, the former being predominant in dry climates, the latter in humid climates Dahire-Binsu et al. (2009). The uptake of minerals is rather high. Indicative figures for total nutrient uptake per hectares of a crop with a fruit yield of about 10<sup>th</sup> ha<sup>-1</sup> are 100 kg N, 10 kg P, 60 kg K, 80 kg Ca and 40 kg Mg Kumar et al. (2010). Under humid tropical conditions a full grown crop consumes about 8 mm of water per day. A ration crop flowers soon after cutting, but usually results in poor quality fruit with a high percentage of bent fruits Purseglove (1987), Anant & Manohar (2001).

### Irrigation and Watering Systems

Thailand has an abundance of water, but growing demand, regional deficiencies and problems with contamination have placed pressure on the resource. Large-scale deforestation also has increased watershed degradation DoAE (2002). 5.76 million ha are irrigated (mostly for rice), with 46% in central, 26% in the northern, 17% in the northeast and 12% in the southern regions with increasing pressures on supply, cost-effective strategies are needed to ensure sustainability. Improved technologies are available but costs (and also access in

some areas) are a constraint. Strategic USC of on-farm storage can lift productivity in dry areas (DoAE 2007, Tipraqsa et al. 2007).

### Meaning of Mulching

Mulching is the process or practice of covering the soil/ground to make more favorable condition for plant growths, development and efficient crop production. Mulch technical term means covering of soil, while natural mulches such as leaf, stray, dead leaves and compost have been used for centuries, during the last 60 years the advent of synthetic materials has altered the method and benefit of mulching. The research as well as field data available on effects of different mulch types on okra growth performance make a vast volume of literature. It therefore prevent directs evaporation of moisture from the soil and thus limit the water losses and soil erosion over the surface. The suppression of evaporation also has a supplementary effects, it prevent the rise of water containing salt which is important in countries with high salt content water sources.

### Advantages of Mulching

- It prevents the direct evaporations of moisture from the soil and thus limits the water losses and conserves moisture.
- Mulch can facilitate fertilizer placement and reduce the loss of plant nutrient through hatching.
- Mulching can provide a barrier to soil pathogens.

### Propagation and Planting

Most farmers harvest seed from their own local cultivar or rather heterogeneous landrace Moekchantuk and Kumar (2004). The easiest way to keep the seed is to leave it in the pods. Seed weight varies from 30 to 80 g 1000' seeds. To soften the hard seed coat, the seed is often soaked in water or chemicals prior to sowing. The seed is usually dibbled directly in the field (2-3 seeds per hole). Optimum plant densities are in the range of 50,000—60,000 plants ha<sup>-1</sup> Olasotan (2001). Emergence is within one week. When the plants are about 10 cm tall, they are thinned to one plant per hole. Germination and initial growth are improved greatly by cultural practices that lower soil temperature, e.g. mulching, watering before the hottest part of the day', and sowing on ridge sides least exposed to direct sunlight Splittstoesser (1984) and Doijode (2001).

## MATERIAL AND METHODS

### Experimental Site Description

The experiment was conducted at the Ramat Polytechnic

Teaching and Research farm Maiduguri during the dry season between May to July, 2013. Maiduguri i.e. on latitude 1 1.4°N and longitude 13.05°E it has the altitude of 354m above sea level Itess T. M., (1988).

### Experimental Design and Treatment

The experimental was laid out in a randomized complete block design (RCBD) and the treatments were replicated three times. The gross plot was (9.5m x 7.0m) consisting of 12 plots and the experimental unit was 2m X 2m, 0.5m in between and 0.25m are external boundary.

The treatments were different mulching materials which are as follows;

- T1 - Sawdust
- T2 - Polythene Sheet
- T3 - Sorghum Straw
- T4 - Control (No Mulch)

Total plants stand was constant for as the treatment and arrangement of the various treatment i.e. shown on Figure 1 as provided.

### Source of Seeds

Seeds of okra were sourced from a certified seed retailer which where procedure from the market.

### Fertilizer Application

Farm yard manure (Poultry) was applied to the Research Farm at 500g per plot.

### Watering

During the establishing the whole plant were watered twice a day with a watering can and bucket on the onset of raining season watering was supplemented.

### Parameters

Parameters that were measured and recorded with the method of measurement are:

1. Soil moisture content in morning and non-every day.
2. Soil temperature in different soil depth every day.
3. Height of plant at 6 weeks.
4. Numbers of leaves at 6 weeks.
5. Weed counts at 6 weeks.
6. Yield or bloom at harvest.

### Weed Count

Emerged weed was recorded by counting the total number of emerged plants stand<sup>-1</sup> at 2 WAS from net plot in order to access the effect establishment of the crop.

**Figure 1.** Experimental site layout

T1R1	T4R1	T3R1	T2R1
T3R2	T2R2	T1R2	T4R2
T2R3	T1R3	T4R3	T3R3

**Key/Legend**

T- Treatment

R- Replication

Treatment 1. Sawdust

Treatment 2. Polythene

Treatment 3. Sorghum straw

Treatment 4. Control

**Table 1.** Effect of mulching on performance of okra and weed control.

S/No	Treatment	Plant Height	Flower Bud	Weed Count
1.	Saw Dust	23.93 <sup>a</sup>	3.67 <sup>a</sup>	19.33 <sup>a</sup>
2.	Polythene	22.50 <sup>a</sup>	2.67 <sup>a</sup>	48.33 <sup>a</sup>
3.	Sorghum straw	22.90 <sup>a</sup>	1.33 <sup>a</sup>	57.33 <sup>a</sup>
4.	Control	19.10 <sup>a</sup>	1.00 <sup>a</sup>	57.33 <sup>a</sup>
	L.S.D (5%)	7.01	3.35	54.73

**Table 2.** Effects of mulching on soil moisture and temperature.

S/No.	Treatment	Soil Moisture	Soil Temperature
1.	Sawdust	69.10 <sup>a</sup>	30.77 <sup>ab</sup>
2.	Polythene	80.73 <sup>a</sup>	32.07 <sup>a</sup>
3.	Sorghum Straw	83.60 <sup>a</sup>	29.73 <sup>b</sup>
4.	Control	75.43 <sup>ab</sup>	31.03 <sup>ab</sup>
	L.S.D (5%)	9.71	2.12

**Plant Height**

The plant height of Okra was measured with a graduated meter rule from the soil surface to the tip of the flag leaf at harvest, where five randomly selected plants in each plot height plot<sup>-1</sup>

**Soil Temperature**

Soil temperature plot<sup>-1</sup> was recorded with the use of laboratory based thermometer at different soil depth in the morning and the evening.

**Statistical Analysis**

All data were subjected to analysis of variance using the ANOVA method and difference between treatments means were identified using least significant difference test (LSD).

**RESULT AND DISCUSSION**

Table 1 summarize the growth data, okra performances and weed suppression of the different mulching types. Where differences are observed, but they was no any significant difference as recorded at 0.05 LSD.

Soil moisture conservation was observed under polythene and sorghum straw (table 2), this result was in line with the findings of Abdul Hafeez and Abu-Gourk (1984). The difference with the other treatments was not significant. The higher moisture conversion under the polythene mulch was mostly due to prevention of evaporation from the soil surface Puszai (1972).

Soil temperature was significantly higher under the plastic mulches than the other treatments, plastic mulches absorb comparatively large amount of the incoming radiation and transmit a considerable part of it to the soil underneath Tarara, (2006). Soil temperature was lowest with the use of sorghum straw mulch (Table 2), which is best for agronomic practices Abdalla, (1969)

## SUMMARY, CONCLUSION AND RECOMMENDATION

The results obtained from the field study carried out at the research and teaching farm of the Department of Agricultural Technology, Ramat Polytechnic Maiduguri during the dry season from March-June 2013, to examine the effects of different mulching types on the growth performance of Okra (*Abelmoschus esculentus*) which shows that plant height, weed count and considerable bud count i.e. high in polythene mulch, and low soil temperature was recorded in sawdust and sorghum straw mulch.

In conclusion although most of the mulching materials have showed some promises, polythene sheet mulch had a high growth performance in comparison.

Therefore, for optimum growth production of Okra under Borno state agro-ecological climate, it is recommended that the polythene mulch is use as an agronomic practice by farmer. It can be suggested that further researcher should be carried out along the following line;

1. Other mulching materials should also be used.
2. Other crops should also be researched on mulches etc.

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