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Response of Sunflower (*Helianthus annuus L.*) Varieties to sowing dates in Jigawa, Semi-arid Agro Ecology of Nigeria

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ABSTRACT

Planting at appropriate time leads to good crop yield; hence the need for detailed investigation on optimum planting dates of sunflower (4th most important oilseed crop in the world). Sunflower production in Jigawa state is capable in playing vital role in both human and animal nutrition, poverty reduction and in changing farmers' socio- economic status. Experiment was thus carried out to determine the appropriate planting time of two varieties of sunflower in Jigawa State, Nigeria. Two varieties of sunflowers, "SAMSUN-1 and SAMSUN-4 (Funtua)", were subjected to three planting dates (Mid-June, Late June and Early July) as subplots arranged in split plot layout in randomised complete block design with three replications. Data on vegetative, reproductive and yield parameters were collected to assess the influence of the treatment combinations on productivity of sunflower. Data collected was subjected to analysis of variance using Genstat 17th edition. Significantly differed means were ranked using LSD. The results of the study revealed that although SAMSUN-1 has the highest values for growth stem girth, the difference between the varieties in terms of stem girth is not significant. Significant difference is however observed in disc diameter where SAMSUN-1 recorded higher disc diameter than SAMSUN-4. The differences in head weight and seed yield of the varieties were not significant. Sowing dates differed significantly for all parameters where highest values were recorded with mid-July sowing date. Significant interaction was observed between variety and sowing date for all parameters. It is concluded that farmers in the study area should use mid-July as prepared planting date for sunflower and use SAMSUN-1 or Futua variety.

Keywords: Sowing dates, SAMSUN-1, SAMSUN-4 and Sunflower yield

Introduction

Sunflower (*Helianthus annuus* L.) occupies the fourth position among vegetable oilseeds after soybean, oil palm and canola in the world (Rodriguez *et al.*, 2002 and Ahmad *et al.*, 2011). It is cultivated for the high concentration ($900 \text{ g}\cdot\text{kg}^{-1}$) of unsaturated fatty acids in its oil (Burton, *et al.*, 2004). The crop has been receiving steady attention by various scientists from diverse disciplines in recent past because sunflower oil is a premium oil with light colour and is widely used in the diets of heart patients because it contains very low cholesterol and high (90%) unsaturated fatty acid concentration (Qahar *et al.*, 2010).

Sunflower oil is considered as premium when compared to other vegetable oils and is the largest selling oil in the branded oil segment. The crop requires a cool climate during germination and seedling growth. It requires warm weather from the seedling to flowering stage and sunny days during flowering to maturity. Sunflower can be grown on a wide range of soils and tolerates a moderate pH range and some salinity. It thrives best on deep loam soils with good drainage and irrigation facilities. Plant spacing is a major production factor that is often manipulated in order to ensure adequate plant population and to reduce yield losses due to overcrowding in arable crops. The choice of appropriate plant population also depends on the cost of planting methods, especially for hybrid seeds, because high quality seeds constitute a major prerequisite for successful production of oilseed crops Bindu, *et al.*, (2017)

Although sunflower is generally regarded as a temperate zone crop, it is currently cultivated on approximately 23 million hectares in 40 countries of the world, including some countries in tropical Africa because it is quite rustic and can perform well under varying climatic and soil conditions (Kaleem *et al.*, 2011).

The crop was introduced from North America into Nigeria shortly after the independence (Ogunremi, 2013). Lately, it has grown in importance as an oil crop second to soybean as a source of edible vegetable oil. It is a successful crop both in irrigated and in rain fed areas, with adequate sunlight, well loosed, and properly drained sandy loam soil (Agele, 2003). Sunflower has a deep tap root system in addition to proliferation of surface lateral

roots which make the crop fairly drought tolerant (Agele, 2003). It was introduced to Nigeria as an alternative oil crop to existing oil crops.

Sunflower takes up large amount of nutrients over a short period and the uptake is affected by many ecological factors namely soil water relationship, weather, nutrient supply and other soil factors (Chapman *et al.*, 1993). Each cultivar of sunflower has different best sowing dates in southern Nigeria, referred to as cultivar and sowing dates interaction. For instances, as a late season, crop “Peredovik” produced its best yield when sown in early July whereas “Russians Giant” yielded most when sown during the first week of August. Allam *et al.*, (2003) also noted that high humidity during seed filling should be avoided. Planting date exerted significant influence on vegetative traits along with yield and its component. Esechie (1994) observed that late planting delayed emergence, flowering and maturity in Islero and *Upsol veraflor* hybrid of sunflower. In Florida, lateness in planting have been observed to reduce yield of sunflower achene and even the distribution of oleic and linoleic acid content in the oil (Robertson and Green, 1981). This contribution reports the effect of climatic change on sunflower productivity and the best planting date for the two varieties cultivated in Nigeria.

The productivity of sunflower in terms of seed yield, oil and protein output varies widely depending on multifarious factors of the environment such as radiation (Dosio *et al.*, 2000), temperature (Kaleem *et al.*, 2009 and 2011a), rainfall distribution (Lawal *et al.*, 2011; Olowe *et al.*, 2013), agronomic practices like time of sowing (de la Vega and Hall, 2002; Lawal *et al.*, 2011; Anjum *et al.*, 2012), plant density and nitrogen nutrition (Ali *et al.*, 2012), varying planting pattern (Yasin *et al.*, 2013) and sowing of improved varieties and hybrids (Ali *et al.*, 2011).

In Nigeria there is the need to give great emphasis to sunflower production, to reduce the gap in oil production (Oholson, 2012), especially because of its drought tolerance and suitability to wide range of soil conditions (Abdou, 2011). However, certain factors are known to have some influence on the performance of sunflower. Prominent among these is sowing date (Abdou, 2011). The

research findings and all other available information on the production for the crop are scattered here and there and are not readily available to enhance increased production.

Sunflower is a relatively new crop for Jigawa State. Information on varietal performance and the effects of sowing date on performance of sunflower in this part of the country is lacking in literature. Thus the potentials of sunflower production in the state need to be fully exploited.

This research intends to ascertain possibility of cultivation of sunflower in the study areas and to evaluate the best planting date for the two varieties cultivated in Nigeria.

Materials and methods

Two Early maturing, drought tolerant varieties of sunflower were used.

Treatments and experimental design: The treatment consists of three sowing dates (early July, mid-July and late-July) and two varieties of sunflower (SAMSUN-1 and SAMSUN-4/Funtua) combined and laid out in split plot designed in randomized complete block design (RCBD) with planting date as sub-plot and cultivar as main-plot.

Plot size: The total area for the experiment was 21m × 11m (231m²) and the plot size was 3m x 3m (9m²). An alley of 0.5m and 1m was left between plots and replicates, respectively. Seeds were planted at 30 by 75 cm plant spacing on 3 by 3 m treatment plot size, giving 60 plant stands per treatment plot. The crop was harvested at physiological maturity. The flower heads were cut off and sun dried in stalks.

Table 1: effect of planting date on yield attributes of sunflower varieties

Treatment	Stem Girth (cm)	Disc diameter (cm)	Head weight (Kg/ha)	Seed yield (Kg/ha)
Variety				
SAMSUN-1	3.48	10.22	2205.98	1355.66
SAMSUN-4	3.61	9.43	2042.42	1268.04
LSD	NS	*	NS	NS
Sowing date				
Early July	3.06	8.65	1446.93	926.43
Mid July	4.04	11.23	2984.59	1782.73
Late July	3.53	9.60	1941.08	1226.39
LSD	0.513	0.878	539.708	374.58
VxS	*	*	*	*

Information about rainfall maximum and minimum temperature, relative humidity wind speed and sunshine hours of the growing season were obtained from metrological station of the Jigawa State Agricultural and Rural Development Authority (JARDA).

Five plants were randomly selected two middle rows of each plot and tagged for data collection. Agronomic data was on collected on plant height, stem girth, head diameter, head weight and seed yield. Growth characteristics such plant height and Stem Girth (cm) were measured 10 days before harvest. At the harvest, yield characters such as disc diameter and head weight were measured, the heads were dried and threshed, 1000-seed weight determined and seed yield calculated. Seed yield was adjusted to a 10.0% moisture basis.

Data collected on the growth and yield components was subjected to analysis of variance using Genstat 17th edition. Significant treatment means were separated at 5% level of probability using LSD.

The results of the study revealed that although SAMSUN-1 has the highest values for growth stem girth, the difference between the varieties in terms of stem girth is not significant. Significant difference is however observed in disc diameter where SAMSUN-1 recorded higher disc diameter than SAMSUN-4. The differences in head weight and seed yield of the varieties were not significant.

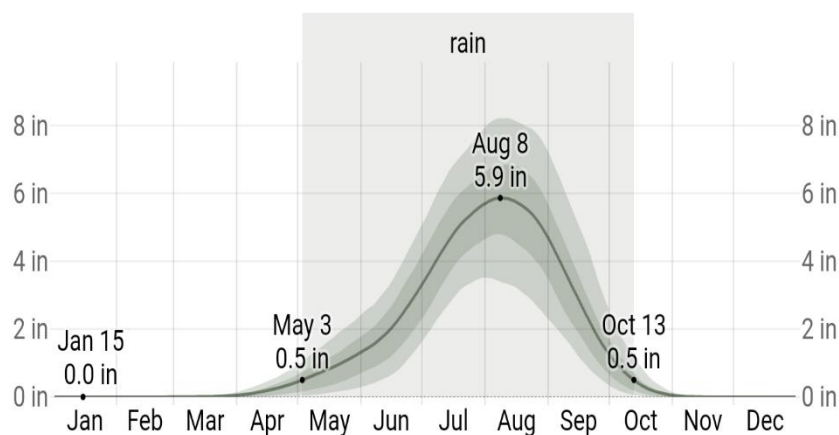


Figure 1: monthly rainfall received in Gumel, 2022

Sowing dates differed significantly for all parameters where highest values of stem girth, disc diameter, head weight and seed yield are recorded with mid-July sowing date. Significant interaction was observed between variety and sowing date for all parameters.

It is established fact that genotype is the major yield determinant of sunflower, several researchers: Ozer *et al.*, 2003; Karaaslan *et al.*, 2007; Ali *et al.*, 2012; Nasim *et al.*, 2012; Hussain *et al.*, 2015 suggested that the cultivars showed wide differences in their agronomic characteristics and seed yield.

The differences in growth and yield parameters between the varieties could be attributed to varietal differences. Although all parameters recorded were not significant except disc diameter of the varieties. This contrast the findings of Erdogan *et al.*, (2017) that the head diameter obtained from the two cultivars were alike in both years. They also reported statistical significant differences between two sunflower cultivars for seed yield in both years, where Sirena tended to be higher in seed yield (2873 and 3330 kg ha⁻¹) than Teknosol (2233 and 2618 kg ha⁻¹) which is a genotype dependent characteristics.

Seed yield is considerably affected by the ecological factors and agricultural techniques as well as the genotype. The productivity of sunflower is largely determined by the prevailing weather conditions throughout its life cycle and the imposed cultural practices (Kaleem *et al.*, 2011). Agricultural applications such as sowing date and fertilizer application and some environmental factors

(temperature and rainfall) are major factors which affect plant growth and development.

The findings of this research agrees with the findings of Erdogan *et al.*, (2017) who reported that sowing dates affected head diameter and ratio of dehulled/hulled seed weight ($p < 0.01$), oil content, seed and oil yield ($p < 0.05$) except plant height and thousand seed weight. Also, Ahmed *et al.*, (2015) observed Significant variation due to varying sowing date in dry matter, head size, thousand seed weight, seed weight /plot, and yield but not plant height. Baghdadi *et al.*, (2014) concluded that seed yield generally decreased with delayed sowing which might be attributed to the decrease in some yield components. According to, Martre (2009) and Bajehbaj (2009), longer growing times in the field for some cultivars resulted in higher yield and yield components such as head diameter, 1000 seed weight, and seed yield. That is, those planted early had their seed filling stage with adequate moisture compared with those planted late; as a result, they had good seed settings. This increase in seed yield with first sowing has been verified in early field studies (Soleymani *et al.*, 2013; Baghdadi *et al.*, 2014; Ahmed *et al.*, 2015).

Conclusion

It is concluded that farmers in the study area should use mid-July as prepared planting date for sunflower and use SAMSUN-1 or SAMSUN-4 variety.

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