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Full Length Research Paper

Effect of phosphorus and sulphur on oil content of Sesame (*sesemum indicum L.*) Varieties in Sudan Savanna Region of Nigeria

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Information on phosphorus sulphur fertilizer requirements of some new sesame varieties in Semi-Arid ecological regions is deficient therefore the need to evaluate the effects of P and S has become necessary. Two sets of experiments were therefore, carried out to evaluate the effect of phosphorus and sulphur on the oil content of sesame (*Sesame indicum* L.). The experiment was conducted during 2009 raining season at teaching and research farm, faculty of Agriculture Bayaro University Kano ($11^0$58 and $8^0 25^{-1}$E) and Jahun, Jahun Local Government of Jigawa State ($12^0 3^1$N and $9^0 35^1$ E). The soils of two locations were sandy loam, with 800mm and 400mm of rainfall at Kano and Jahun site respectively. The treatment included three sesame varieties (E8, Sudan and Yandev 55), four levels of $P_2 0_5$ (0,20, 40 and 60kg ha^{-1}and four levels of sulphur (0, 15, 30, and 45kg s ha^{-1})A randomized complete block design was used and replicated three times. Result revealed that sesame variety and phosphorus fertilizer had significant effect on oil content (48.8%) at Kano. Sulphur had significant effect on oil content at Jahun where 30 kg S ha^{-1}produced 49.66% oil. Sudan variety had the highest oil content and E8 had the lowest oil content. There was interaction effect between variety, phosphorus and sulphur on oil content at Jahun. Therefore, sesame need fertilizer for good production of oil and more investigation should be carried out for confirmation.

Key words; Sesame, Oil content, Savanna Region, Sulphur and Phosphorus

INTRODUCTION

Sesame is an old oil seed crop known in the world which has many species in the wild and some are domesticated. It is a native of sub Saharan Africa. It can grow in areas with less rain fall and in wide range of soils including sandy none nutritive or infertile soils of Sahara Regions. It grow up to 50 – 120 cm in height. Sesame have different colors ranging from white, red brown and black.

Sesame belongs to the flowering plant of genus Sesamum and belongs to pedaliaceae family. There are numerous wild varieties which occur in Africa and some in India It is widely naturalized in tropical regions around the World. It is mostly cultivated for its edible oil and seeds that grow in dehiscent pods. The world harvest in 2014 was about 6.3 million metric tons. Tanzania and India are the largest producers followed by Sudan and Nigeria.

Sesame occupies the 16th position in the world veget-

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-able oil producing oil crop (FAO, *2008*), the largest producers are Chine and India, followed by Burma, Sudan, Mexico and Nigeria. Nigeria ranks the 8^{th} position in sesame production in the world, producing about 408,000 metric tons as at 2005 cropping season (AGSA, *2008*). The importance of the crop lies on the high protein, calcium, iron, methionine and good quality oil contents, which is about 50% of the seed weight (Gupta et al. 1998 and Babaji *et al. 2006*). The oil is good for cooking, salad and used as ingredients in soap lubricant and illuminant in pharmaceuticals, paints and synergist for pyre her aerosols sprays (Pursglove, *1986*).

Apart from Nigerian being one of the largest procedures of sesame in Africa, the estimated yield on farm field is about 4800 kg ha^{-1} which is low compared 1083 and 1960 ha^{-1} obtained in Saudi Arabia and Venezuela respectively (Muhammad and Gungula, *2009*). The low yield obtain in Nigeria may be attributed to low fertility status of the soil and lack of proper fertilizer type and rates. The use of fertilizer in growing sesame has remained very controversial, as a rate differs with location within Nigeria (Haggai 2004, Babaji *et al. 2006* Muhammad and Gagual 2009 and Okpara *et al*. 2007). The low yield obtained in Nigeria soils, particularly in the savanna zones is attributed to the low status of which P and S which are major and minor nutrients respectively (Okpara et al 2007). These nutrients (P and S) play an important role in the production of oils crops.. Manker *et al*. (1995) reported increase in oil contents of sesame with applicant of 50kg $P_2 0_5$ ha $^{-1}$. Oil yield increased up to 71 %. Salwat *et al*. (2009) reported that oil percentage in sesame was significantly affected by up to 71% application of elemental sulphur and micronutrients. Maragatham *et al*. (2000) stated that application of sulphur up to 40kg s ha^{-1} increased sesame seed oil content from 47.63% (0k s ha $^{-1}$) to 49.83% with 40kgs ha^{-1} Tiwari *et al*. (1997) Thirty Kilogram per hector produced 50.7% oil content in sesame, while 45kg S ha $^{-1}$ produced 48.7% oil content Tiwari *et, al*. (1997).

The study was carried out to determine effects of P and S. on sesame oil content.

MATERIALS AND METHOD

The experiment was conducted during 2009 cropping season at two locations. The Teaching and Research farm of Faculty of Agriculture, Bayero University Kano (Latitude $11^0$58" N and longitude $8^0 25^{-1}$E) with annual rainfall of about 843mm and mean annual temperature of 36.11^{0}C. The second location was Jahun, in Jahun Local Government Area of Jigawa State, it lies between latitude $12^0 03^1$Nand longitude $09^0$33" E, with mean annual rainfall of about 400 mm and mean maximum temperature of 36^{0}C. The study areas are both located in semi-arid regions of Nigeria.

The treatments constituted four levels of phosphorus in from of triple super phosphate (0, 20,40, and 60kg ha $^{-1}$) and four levels of sulphur elemental (0, 15, 30 and 45kg ha^{-1}) with three sesame varieties (E8, Sudan and Yardev 55 variety). The treatments were laid out in a randomized completed block design and replicated three times. A gross plot size of 13.5cm^2 and net plot size of 3.74cm^2 were used. The seeds were sown on at spacing of 15cm intra row and 75 cm inter row. Two weeks after sowing the seedling were thinned to two plants per stand. Phosphorus and Sulphur were applied at sowing at the rates of, 0, 20, 40, 60 and 0, 15, 30 and 45 kg S ha $^{-1}$ respectively. At three weeks after sowing, basal application of nitrogen in forms of urea was applied at 40kg ha^{-1}

Five plants were randomly selected from each plot for evaluation. Two grams seed sample was collected from each plant and analyzed for oil Contents using ether extract and analyzed as described by Krisma and Rajhar (1980) and Malik *et al*. (2000). The data collected was subjected to analysis of variance (ANOVA) by suing SAS V_8 2000 and means were separated using Duncum multiple range test DMRT as described by Snedeco and Cochram (1967) Simple correlations among some of the variable were determine to assess the relationship among variables.

RESULTS AND DISCUSSIONS

Oil content was affected significantly by the treatment at Jahun (Table 1), where Sudan variety had the highest oil yield of 48.71% (Table 1) this may be caused by the genetic yield ability of the variety. This agreed with the work of Anon (1996) that the improved varieties of sesame produced the highest percentage oil content and oil yield.Thus variation obtained in oil yield, may be due to the varietal responses (Egbokun and elieza, 1997), cultivation and climate. Phosphorus application resulted in significant increase in oil yield (38 %) in Kano (Table 1), similar result was obtained by Katherison and Darmaligon (1999). Davasgayen and Paul (1997) observed that oil yield in sesame significantly increased with application of phosphorus. Application of Sulphur at 30kg ha^{-1} significantly have affected oil content in Jahun, producing the highest yield (49.66%) this may be caused by the involvement of sulphur in oil synthesis, as it is a constituent of oil glands and play a role in lipid metabolism (Maschner 1996). This agreed with the works of Raja *et al.* (2007), and Salwat *et al*. (2009) that the percent oil contents of sesame was significantly affected by application of sulphur. Tiwari *et al.* (1997) reported that 30kg s ha^{-1} produced 43.71kg ha^{-1} (51.34%) seed oil in sesame.

Table 1. Effect of phosphorus and sulphur on oil content at Jahun.

	JHN	KANO
E8	44.21a	42.31
Yandev 55	43.50b	45.90
Sudan	48.71a	43.78
SE+_	1.3	1.8
Phosphorus (P_2O_5 kgha^{-1}		
0	48.08	42.25b
20	46.00	45.45ab
40	44.25	40.33c
60	43.58	47.91a
SE	2.7	2.1
Sulphur (S)		
0	44.04	43.66
15	47.75	44.58
30	49.66a	43.91
45	44.48	43.83
SE±2.7		
Interaction		
p x s	NS	NS
v x s	*	NS
v x p x s	**	NS

means followed by the same letters in a column are not significantly different at 50 % level of probability.*=significant, N S = not significant ** highly significant

Table 2. Interaction between variety with sulphur on oil content (%) of sesame in Jahun

Sulphur (kgha^{-1}				
Variety	0	15	30	45
E8	46.00ab	47.50ab	38.88b	40.50b
Sudan	46.88ab	53.38a	53.25a	41.50b
Yandav55	39.25b	42.38ab	44.88ab	47.50ab
SE				

Mean followed by the same letter (s) in the column are not significantly different at 5% level of probability

There was an interaction between variety and sulphur at Jahun (Table 2), where Sudan variety produced up to 64.5% oil yield Jahun, Sudan, variety performed better oil yield with application of 30kg ha.$^{-1}$ Similar observation was made by Govinderusu *et al*. (1998), were sesame variety KS5010 responded with 50kg s ha^{-1}. there was significant effect of the treatment on oil content of sesame in Jahun, were Sudan variety produce (64.5%) oil content with application of 60kg P_20_5 ha^{-1} combined with 30kg S ha-^{1} While E8 variety produce 56.5% oil with 20kg P_20_5ha^{-1}Salwat *et al.* (2009) reported that % oil in sesame was significantly affected by application of element sulphur, while Raja *et al*. (2007) reported that 60kg S ha^{-1} produced 50.7% oil yield and 45kg S ha^{-1}produced 48.7% oil content in sesame.

Application of 30kg S ha^{-1} with 60kg P_20_5 ha^{-1} produced the highest oil content. Sudan variety significantly produced 48.9% oil content at Jahun and phosphorus significantly affect oil content at BUK, where at 60kg P_20_5 ha^{-1} produced 47.91% oil. From the result found it can be concluded that sesame (*Sesamum indicum* L) may requires P and S fertilizers for good oil yield yield and Sudan variety produced the highest oil content.

CONCLUSION AND RECOMMENDATION

From the above findings it can be concluded that oil content is affected by both sesame variety and treatments where phosphorus and sulphur affect the amount of oil content. Application of 30kg S ha^{-1}with 60kg P_2O_5 ha^{-1} produced the highest oil content and Sudan variety significantly produced 48.9 % oil at Jahun. Phosphorus had significant effect on oil content in Kano, where 60kg P_2O_5 ha^{-1} Produced 47.9% oil Therefore it can be recommended that 30 kg S ha^{-1} and sudan variety should be used for good oil yield.

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