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Effect of Seedbed Preparation and Sowing Methods on Seedling Emergence, Growth and Yield of Sesame on an Ultisolin Kogi State, Nigeria

Ogundare, S.K.*

[1] College of Agriculture, Division of Agricultural Colleges, Ahmadu Bello University, Zaria, Nigeria.
*Corresponding author: drogundarekayode@yahoo.com

ABSTRACT

This study was carried out at the Teaching and Research Farm of the Agronomy Department, Kabba College of Agriculture in year 2015, and repeated in year 2016 to investigate the effect of seedbed preparation and sowing methods on seedling emergence, growth and yield of sesame in an Ultisol. The treatments consisted of six sowing methods (broadcasting, drilling at 25 cm interval, drilling at 50 cm interval, spot planting at 10 x 25 cm, spot planting at 20 cm x 20 cm, spot planting 20 cm x 25 cm) and four seed bed preparation methods (plough alone, plough plus harrow, plough plus double harrow, and plough plus harrow plus ridge) arranged in all possible factorial combinations and laid out in a randomized complete block design. Data were collected from ten randomly selected plants in each plot. Data were taken on the basis of agronomic traits such as on establishment count, plant height, number of leaves per plant, number of branches, stem girth, leave area, panicle length, panicle weight, number of seed per pod and number of seeds per plant. All the data were subjected to analysis of variance (ANOVA) to determine the significance of variations among the treatments and means were separated using Least Significance Difference (LSD) test at 5% level of probability. The result revealed that plots with plough + harrow twice were significantly better in percentage seedling emergence than plots with plough alone, plough + harrow and plough + harrow + ridge. Sesame either broadcast or drill had better growth characters when compared to sesame spot planted at different inter and intra row spacing. Plots with plough + double harrow and plots with plough + harrow + ridge were significantly better in growth characters than plots with either plough alone or plots with plough + harrow. Number of capsules per plant, individual capsule weight, weight of capsules per plant and number of seeds per capsule were highest in plots planted by drill method compared to spot and broadcast methods. Plots with plough + double harrow and plots plough + harrow + ridge were significantly better in capsules characters than plots with plough Alone or plough + harrow once. Broadcasting significantly produced lower seeds yield compared to drilling and spot planting. Plots with plough + double harrow and plots plough + harrow + ridge were significantly better in seed yields per plot and seed yield per land area than plots with either plough Alone or plough + harrow once. Lodging percentage was highest in plots with plough + harrow + ridge compared to plots with either plough Alone, plough + harrow once and plough + double harrow.

Key words: Sesame, Seedbed, Sowing, Broadcasting, Drilling and Spot

INTRODUCTION

Sesame (*Sesamum indicum* L.) is widely grown in tropical and subtropical regions of Asia, Africa, South and North America for edible oil and for animal feed production. Among the traditional sesame growers in Nigeria, the crop is considered a minor crop (Haruna and Usman, 2005). Sesame is the most conventional oil seed crop cultivated for its edible oil in Nigeria. Sesame is known as the king of oil seeds due to the high oil content (50% - 60%) of its seed (Toan *et al*., 2010). Sesame oil is used as foods (cooking and salad), medicine and soap manufacturing etc. The oil-cake is good feed for poultry, goat, sheep, fish and cattle (Khan, 2009). Unfortunately, growth and yield of the crop are generally low. Seedbed preparation is considered one of the factors for increasing the yield of sesame per unit area. According to (Lal, 1986), the primary aims of good seedbed preparation are: to control weeds, manage surface trash, provide aeration, shape or level the soil, improve physical conditions of the soil, incorporate fertilizers, break hard pans and allow better water and air infiltration. Soil compaction is generally defined as an increase of the natural density of soil at a particular depth (Quin *et al*, 2006). The bulk density increase translates into less pore space, less water available to plants, slower water transportation and decreased roots. The roots can penetrate the compacted zone as it seeks out water and nutrients, but the formation of lateral roots can reduce (Singh and Malhi, 2006). Similarly, bulk density increase due to compaction can serve to retard or divert the flow of water, resulting in

pond formation or excessive run off. Soil moisture is the source of water for plant use, particularly in rain-fed agriculture (Mweso, 2003). Soil moisture is critical in ensuring good and uniform seed germination and seedling emergence (Arsyid, 2009), crop growth and yield.

Carver (2005) investigated the impact of different crop establishment methods as conventional drilling, precision drilling and broadcasting in winter wheat. Broadcasting method produced the most effective spatial arrangements. However, there was no consistent relationship between any of the spatial arrangements and yield performances. Singh *et al.* (2005) concluded that in wheat, strip drilling resulted in higher growth and grain yield (5.67 t ha^{-1}), followed by zero tillage drilling, conventional sowing and bed planting. The broadcast sowing generally gave lower yield than sowing in rows (Krezel and Sobkowicz, 1996). However, Ahuja *et al.* (1996) recorded 5.08 t ha^{-1} grain yield with broadcasting while 4.75 t ha^{-1} with sowing in 23 cm apart rows, while Raj *et al.* (1992), Abbas *et al.* (2009) found that, row spacing (15, 22.5 or 30 cm) had no effect on grain yield but the yields were lower in the wider row spacing (30 cm). Parihar and Singh (1995) revealed that, cross sowing increased grain yield by 4.3% compared with the normal method of sowing (line sowing).

In Nigeria, sesame production is low due to a number of constraints which include: poor farmers' access to improved varieties, appropriate agronomic practices, drought and low soil productivity. Presently studies on sesame agronomic practices in Nigeria are mostly on plant population, fertilizer rate, and row spacing in the Guinea savanna zone (Malik *et al.*, 2003). However, research on sowing methods and land preparation methods has been scanty particularly in the southern Guinea savanna zone of Nigeria. Since there is paucity of research on sesame in the southern Guinea Savanna agro-ecology, it was necessary to conduct this study with the objective of determining the influence of seedbed preparation and sowing methods on emergence, growth and yield of sesame seedlings in an ultisol in Nigeria.

MATERIALS AND METHODS

This study was carried out at the Teaching and Research farm of Kabba College of Agriculture in 2015, and repeated in 2016. The site is located at latitude of 07° 35' N and longitude of 06° 08' E and is 435 m above the sea level, in Southern Guinea Savanna Agro Ecological Zone of Nigeria. The rainfall spans between April and November with its peak in June. The dry season extends from December to March. The mean annual rainfall is about 1350mm per annum with an annual temperature range of 18°C to 32°C. The mean relative humidity (RH) is 60%. The major soil order within the experimental site is Ultisol (Babalola, 2010).

The treatments consisted of six sowing methods (broadcasting, drilling at 25cm interval, drilling at 50cm interval, spot planting at 10 x 25cm, spot planting at 20 cm x 20cm, spot at planting 20 cm x25cm) and four seed bed preparation methods (plough alone, plough plus harrow, plough plus double harrow, and plough plus harrow plus ridge) arranged in a randomized complete block design with three replications. The experiment consisted of seventy-two plots. The plots were weeded manually at three weeks intervals. Poultry manure was applied to all treatments at the rate of five tons per hectare at two weeks before planting.

Data were collected from ten randomly selected plants in each plot and each plot has fifty four plants. Data were taken on the basis of agronomic traits such as on establishment count, plant height, number of leaves per plant, number of branches, stem girth, leave area, panicle length, panicle weight, number of seed per pod and number of seeds per plant. All the data were subjected to two-way analysis of variance (ANOVA) to determine the effects of seedbed preparations and sowing methods on the different agronomic traits. Treatment means found to differ significantly were separated using Least Significance Difference (LSD) at 5% level of significance (Carmer and Swanson, 1973).

RESULTS

Table 1 shows the physico-chemical properties of the soil before planting. The percentage (%) sand, silt and clay of the soil were 64.5, 20.0 and 15.5, respectively; indicating the soil texture to be sand clay loam with the pH of 6.2.

Table 1: Physical and Chemical Analysis of the Soil before the Experiment

Properties	Values
Sand (%)	64.5
Silt (%)	15.5
Clay (%)	20
Soil texture	Sandy clay loam
Soil pH	6.2
Bulk density (g/cm^3)	1.41
Total porosity (%)	42.5
Organic matter (%)	2.14
Total N (%)	0.16
Available P (mg/kg)	2.72
Exchangeable cation (cmol/kg)	
K (cmol/kg)	0.46
Ca (cmol/kg)	2.5
Mg (cmol/kg)	2.54

Table 2: Effect of seedbed preparation and sowing methods on seedling emergence (%)

Treatments	**Days to 50% seedlings emergence**			**Percentage seedlings emergence at 30 days after sowing.**		
Sowing methods	2015	2016	mean	2015	2016	mean
Broadcast	4.08	4.16	4.12	63.7	77.9	70.8
Drilling 25cm interval	4.12	4.22	4.17	69.7	78.5	74.1
Drilling 50cm interval	4.27	4.15	4.21	78.5	70.7	74.6
Spot planting 10 x 25cm	4.19	4.23	4.21	71.4	56.2	63.8
Spot planting 20x20	4.11	4.07	4.09	56.1	67.3	61.7
Spot planting 20x25cm	4.09	4.27	4.18	59.6	62.2	60.9
LSD	ns	ns	ns	4.64	15.61	9.88
Seedbed preparation methods						
PA	4.06	4.26	4.16	64.3	71.3	67.8
P+H	4.11	4.29	4.2	68.4	72.8	70.6
P+H+H	4.24	4.22	4.23	96.1	92.1	94.1
P+H+R	4.1	4.26	4.18	74.3	63.9	69.1
LSD	ns	ns	ns	13.4	17.8	19.62
INTERACTION						
Sowing vs seedbed preparation	ns	ns	ns	ns	ns	ns

The nitrogen content of the soil was 0.14%, which is considerably low The available phosphorus content of the soil was very low compared to the critical levels (10-12 mg/kg) and the exchangeable potassium content of the soil was also low compared to recommended critical level of 0.17cmol/kg for Nigerian soils (Senjobi, 2013). The Ca, Mg and organic matter contents available in the soil were low and the soil pH indicates that the soil is slightly acidic.

Table 2 presents the results of effect of seedbed preparation and sowing methods on days to 50% seedling emergence and percentage seedling stands at 60 days after planting. The result showed that days to 50% seedling emergence were not significantly affected by seedbed preparation and sowing methods. However, percentage seedling stands was significantly affected. Plots with drilling method were significantly better in percentage seedling stands than plots with spot planting methods irrespective of inter row spacing used but at par with plots with broadcast methods. Plots with drilling methods at 50 cm intervals recorded the highest percentage (4.21 days) of seedlings emergence. The lowest percentage (4.09 days) seedling emergence was observed in plots treated with spot planting at inter row spacing of 20 cm and intra row spacing of 20 cm.

Plots with plough + double harrow produced the highest percentage seedling emergence, which was significantly higher than those of the plots with plough alone, plough + harrow and plough + harrow + ridge. Percentage seedling emergence was lowest in plots with plough alone. Interaction between sowing and seedbed preparation methods was not significant at p =0.05.

Growth characters of sesame seedlings as influenced by sowing and seedbed preparation methods are presented in Table 3. Table 3, shows that there were significant difference in plant height, number of leaves, and number of branches due to sowing methods used. Plots with drilling method had the highest plant height and number of branches while the highest number of leaves was observed in plots with broadcast method of planting. In respective of inter and intra row spacing, plots with spot planting method produced shorter plants, lowest number of leaves and lowest branches.

Seedbed preparation method significantly affected plant height, number of leaves and branches. Though plots with plough + harrow + ridge produced higher plant height, number of leaves and branches, They were not significantly better than those of plots with plough + harrow + ridge. Plots with plough alone had the lowest plant height, number of leaves and branches in this experiment.

Table 4 presents the result of effect of sowing and seedbed preparation methods on days to 50% flowering and podding in sesame seedlings. The main effect of sowing method and seedbed preparation method was not significant on days to 50% flowering and podding in this experiment. The effects of sowing and seedbed preparation methods on capsules character of sesame seedlings are presented in Table 5. The result showed that the number of capsules per plant, individual capsule weight, weight of capsules per plant and numbers of seeds per capsule were significantly affected by sowing and seedbed preparation methods. Number of capsule per plant, individual capsule weight, weight of capsules per plant and number of seed per capsule were highest in plots with drill planting method, followed by plots with spot planting method while the lowest number of capsule per plant, individual capsule weight, weight of capsules per plant and numbers of seed per capsule were recorded in plots with broadcast method of planting.

Table 3: Effect of seedbed preparation and sowing methods on growth characters of sesame

Treatments	Plant height (cm)				Number of leaves				Stem girth (cm)				Number of branches			
Sowing methods	2015	2016	mean		2015	2016	mean		2015	2016	mean		2015	2016	mean	
Broadcast	121.2	98	110.1	110	243	262.4	252.7	252.7	2.26	2.02	2.14	2.14	5.48	8.28	6.88	6.88
Drilling 25cm interval	90.7	114.1	102.4	113.2	149.3	162.7	156	181	2.32	2.12	2.22	2.27	7.21	9.01	8.11	8.76
Drilling 50cm interval	132	115.6	123.8		213.1	202.1	207.6		2.43	2.19	2.31		8.96	9.86	9.41	
Spot planting 10 x 25cm	112.7	87.3	100		198.4	235.4	216.8		2.3	1.88	2.09		9.21	8.98	8.98	
Spot planting 20x20	98.7	104.9	101.8	101.4	203.4	226.4	214.9	220.4	2.06	2.44	2.25	2.22	9.02	7	8.01	8.33
Spot planting 20x25cm	117.4	87.2	102.3		248	204	232.2		2.48	2.14	2.31		9.16	7.12	8.14	
LSD	12.96	16.2	12.7		36.6	28.4	24.1		ns	ns	ns		2.29	1.89	2.16	
Seedbed preparation methods																
PA	98.4	106.8	102.6		198.5	216.3	207.4		2.31	2.27	2.29		6.89	8.03	7.46	
P+H	94.8	111.4	103.1		206.1	216,5	211.3		2	2.64	2.32		9.02	8.96	8.99	
P+H+H	108.4	120.8	114.6		219.7	252.3	236		2.41	2.25	2.33		9.19	9.09	9.14	
P+H+R	108.1	123.5	115.8		229.7	242.1	235.9		2.48	2.26	2.37		9.88	10.52	10.2	
LSD	5.4	11.6	5.4		18.4	23.1	14.3		ns	ns	ns		1.11	1.21	1.6	
INTERACTION																
Sowing vs seedbed preparation	ns	ns	ns		ns	ns	ns		ns	ns	ns		ns	ns	ns	

PA = Plough alone, P + H = Plough plus Harrow, P + H + H =Plough plus Double Harrow, P + H + R = Plough plus Harrow plus Ridge.

Table 4: Effect of seedbed preparation and sowing methods on days to 50% flowering and podding

Treatment	Days to 50% flowering				Days to 50% podding			
Sowing methods	2015	2016	mean		2015	2016	mean	
Broadcast	51.12	53.14	52.13	53.13	88.23	89.81	89.02	89.02
Drilling 25cm interval	52.61	51.85	52.23	52.29	88.97	90.19	89.54	89.35
Drilling 50cm interval	52.15	51.97	52.06		88.42	89.9	89.16	
Spot planting 10 x 25cm	52.14	52.74	52.44		87.68	89.54	88.61	
Spot planting 20x20	53.73	52.19	52.96	52.27	89.54	89.16	89.14	89.06
Spot planting 20x25cm	52.15	54.73	53.44		88.23	90.63	89.43	
LSD	ns	ns	ns		ns	ns	ns	
Seedbed preparation methods								
PA	52.78	51.48	52.13		89.14	89.08	89.11	
P+H	53.33	51.13	52.23		89.96	88.86	89.41	
P+H+H	52.54	51.8	52.17		89.79	88.95	89.37	
P+H+R	51.58	52.56	52.07		88	90.56	89.28	
LSD	ns	ns	ns		ns	ns	ns	
INTERACTION								
Sowing vs seedbed preparation	ns	ns	ns		ns	ns	ns	

PA = Plough alone, P + H = Plough plus Harrow, P + H + H =Plough plus Double Harrow, P + H + R = Plough plus Harrow plus Ridge.

Table 5: Effect of seedbed preparation and sowing methods on capsules characters

Treatment	Number of capsules/plant				Individual capsule weight (g)				Number of capsules/plant				Individual capsule weight (g)			
Sowing methods	2015	2016	mean		2015	2016	mean		2015	2016	mean		2015	2016	mean	
Broadcast	128.5	121.6	123.5	123.5	1.11	1.49	1.3	2.3	0.23	0.21	0.22	0.22	767.4	745.2	767.4	767.4
Drilling 25cm interval	149.5	158.3	153.9	139.5	2.03	1.77	1.9	1.72	0.34	0.24	0.29	0.24	1126.5	1075.1	1100.8	997.8
Drilling 50cm interval	134.6	113.8	124.2		1.84	1.24	1.54		0.16	0.22	0.19		1009.2	780.2	894.7	
Spot planting 10 x 25cm	128.9	143.7	136.3		1.56	1.88	1.72		0.27	0.19	0.23		1110.4	743.6	927	
Spot planting 20x20	146.2	136.8	141.5	137.8	2.01	1.77	1.89	1.74	0.31	0.23	0.27	0.24	974.3	682.5	828.4	897.6
Spot planting 20x25cm	144.8	126.2	135.5		1.83	1.41	1.62		0.26	0.18	0.22		872.9	1001.9	937.4	
LSD	10.2	17.8	18.4		0.19	0.62	0.37		0.06	0.27	0.06		135.4	166.8	154.3	
Seedbed preparation methods																
PA	125.6		133.1		1.14		148		0.23		0.2		445.8		588.4	
P+H	149.1		152.6		1.99		1.43			0.26	0.25		568.4		602.6	
P+H+H	206.4	190.4	198.4		2.14	2.04	2.09		0.48	0.34	0.41		989.2	1012.6	1000.9	
P+H+R	196.3	182.9	189.6		2	1.94	1.97		0.41	0.33	0.37		983.9	1002.9	993.4	
LSD	41.1	6.8	17.2		0.15	0.24	0.11		0.08	0.02	0.04		16.4	18.1	12.9	
INTERACTION																
Sowing vs seedbed preparation	ns	ns	ns		ns	ns	ns		ns	ns	ns		ns	ns	ns	

PA = Plough alone, P + H = Plough plus Harrow, P + H + H =Plough plus Double Harrow, P + H + R = Plough plus Harrow plus Ridge.

Table 6: Effect of seedbed preparation and sowing methods on seed yield per hectare

Treatment	1000 seed weight (g)				Seed weight/ plot (kg)				Seed yield/ hectare (t/ha)			
Sowing methods	2015	2016	mean		2015	2016	mean		2015	2016	mean	
Broadcast	22.6	22.22	22.41	22.41	0.85	0.49	0.67	0.67	1.08	0.6	0.84	0.84
Drilling 25cm interval	20.25	24.49	22.37	21.77	1.21	0.96	1.08	1	1.51	1.2	1.35	1.25
Drilling 50cm interval	18.44	23.88	21.16		0.86	0.96	0.91		1.08	1.2	1.14	
Spot planting 10 x 25cm	23.76	21.12	22.44		0.94	1.04	0.99		1.18	1.3	1.24	
Spot planting 20x20	22.31	20.81	21.56	21.77	1.13	0.93	1.03	0.99	1.41	1.16	1.29	1.24
Spot planting 20x25cm	19.93	21.69	21.31		0.88	1.04	0.96		1.1	1.3	1.2	
LSD	ns	ns	ns		0.12	0.16	0.27		0.16	0.34	0.14	
Seedbed preparation methods												
PA	21.56	19.56	20.61		0.53	0.41	0.47		0.66	0.51	0.59	
P+H	19.41	22.51	20.96		0.68	0.5	0.59		0.85	0.63	0.73	
P+H+H	22.17	19.52	21.13		1.21	1.05	1.13		1.52	1.31	1.41	
P+H+R	22.74	21.3	22.02		0.99	1.03	1.01		1.24	1.29	1.26	
LSD	ns	ns	ns		0.11	0.14	0.17		0.32	0.26	0.29	
INTERACTION												
Sowing vs seedbed preparation	ns	ns	ns		ns	ns	ns		ns	ns	ns	

PA = Plough alone, P + H = Plough plus Harrow, P + H + H =Plough plus Double Harrow, P + H + R = Plough plus Harrow plus Ridge.

Plots drill planting at 25 cm intervals had higher number of capsule per plant, individual capsule weight, weight of capsules per plant and number of seeds per capsule when compared with plots with drill planting at 50 cm intervals. The effect of sowing method among the spot planted plants was inconsistence.

Seedbed preparation method significantly affected number of capsule per plant, individual capsule weight, weight of capsules per plant and number of seeds per capsule. Plots with plough + double harrow had the highest number of capsule per plant, individual capsule weight, weight of capsules per plant and numbers of seed per capsule. Though, results of plots with plough + double harrow were not significantly higher than those of plots treated with plough + harrow + ridge, they were significantly higher than those of plots treated with plough alone and plough + harrow. The lowest values of number of capsule per plant, individual capsule weight, weight of capsules per plant and number of seeds per capsule were recorded in plots with plough alone.

Table 6 presents the effect of sowing and seedbed preparation methods on yield parameters of sesame seeds. The results showed that seed yield per plots and seed yield per hectare were significantly affected by sowing and seedbed preparation methods used. However, 1000 seed weight was not affected significantly. Seed weight per plot and seed yield in tons per hectare were lowest in plots with broadcast method of planting. This was significantly lower than those of plots with drill and spot planting methods in both years of the experiment (i.e. 2015 and 2016). Among the drill planting plots, plots drill planted at 25 cm recorded the highest seed weight per plots and seed yield in tons per hectare when compared with those of plots drill planted at 50 cm apart. Also, among the spot planting plots, plant spot planted at inter and intra row spacing of 20cm by 20 cm recorded the highest yield per plot and seed yield per hectare (Table 6). Both seed yield per plot and seed yield in tons per hectare were significantly affected by different land preparation methods used.

Table 7: Effect of seedbed preparation and sowing methods on percentage of seedlings lodged due to wind

Seedbed preparation methods	Percentage of seedlings lodged due to wind
PA	55
P+H	61
P+H+H	42
P+H+R	78
LSD	19.46

PA = Plough alone, P + H = Plough plus Harrow, P + H + H =Plough plus Double Harrow, P + H + R = Plough plus Harrow plus Ridge.

Plots with plough + double harrow had the highest yield in seed yields per plot and per hectare. This was closely followed by plots with plough + harrow + ridge (Table 6).

However, these were significantly better than plots with plough alone or plough + harrow. The lowest seed yield per plot and seed yield per hectare were recorded in plots with plough alone (Table 6). Effects of seedbed preparation on percentage lodging of sesame plants are presented in Table 7. The results showed that percentage lodged was highest in plots with plough + harrow + ridge, which was significantly inferior to plots with plough + double harrow, plough + harrow and plough alone. The lowest lodging percentage was observed in plots with plough + double harrow.

DISCUSSION

The result revealed that main effect of sowing and seedbed preparation methods had no significant effect on days to 50% seedling emergence. This indicated that seeds required similar days for emergence. The non-significant difference in days to 50% emergence was due to a good germination condition enjoyed by the seeds due to regular rainfall at the time of sowing. This result is in agreement with the work of Mayer and Polijakoff-Mayber (1992), who reported that germinations of sesame seed were influenced by moisture and temperature. Percentage seedlings emergence was high in plots treated with drilling method in both years and was significantly higher than in plots with spot application methods. This could be attributed to the fact that a seed drill is a sowing device that positions seeds in the soil and covers them. The seeds were at proper depth and at equal distance, ensuring that seeds are saved from being eaten by birds.

Plots with plough + harrow twice had significantly higher percentage seedling emergence than plots treated with plough alone, plough + harrow and plough + harrow + ridge. Soil pulverization was better when soil undergo double harrow, which could be responsible for the higher seedlings emergence in plots with plough + double harrow. Seedling emergence was lower in plots with plough + harrow + ridge than plots with plough + double harrow. Seed of sesame are small and could be affected by reel erosion that occurred when water flows from the top of the ridge to the furrow water. This could be responsible for low seedling emergence in plots with plough + harrow + ridge.

Sesame seeds either broadcast or drill planted had better plant height, number of leaves and branches when compared to sesame spot planted at different inter and intra row spacing. This is expected because the seedlings were clustered, with each seedling competing for sunlight. Ndarubu *et al.* (1996), reported increase in plant height with decrease in intra and inter row spacing.

As the intra and inters rows spacing decrease, plants compete for above ground resources such as light (Ndarubu *et al.*, 1996). This could be responsible for taller plants and higher number of leaves and branches observed in plots planted by broadcast and drill methods. Plants with spot planting were remarkably shorter and with fewer branches probably due to less competition for light among the seedlings, hence elongation of stem and proliferation of leaves was reduced.

Plots with plough + double harrow and plots with plough + harrow + ridge had significantly better growth characters than plots with plough alone and plot with plough + harrow.

Boguzas *et al*. (2010) reported that good seedbed preparation created favourable conditions for plant growth in loose soils with a proper air to water ratio, sufficient amount of organic matter and high microbiological activity. The better growth characters observed in plough + harrow + ridge and plough + double harrow plots could be probably attributed to good soil physical conditions created when the soil is properly tilled. Number of capsules per plant, individual capsule weight, weight of capsules per plant and number of seed per capsule were highest in plots planted by drill method compared to spot and broadcast methods. This is expected because those plants established through drill method of planting produced taller plants and higher number of branches and flowers are produced on branches. This could be responsible for the higher capsules character in plants with drill planting method. Higher capsule characters were observed in sesame seeds drilled planted at 25 cm compared to sesame seeds drill planted at 50 cm intervals. Increasing row spacing can create weeds problems, wider spacing reduces the crop ability to close the canopy and compete with weeds between rows. This delay inter row weed suppression, the wider the row, the longer the delay. Reports by Norman (1982) and Foidi (2001) indicated that increasing row spacing does not affect individual plants if the row spacing is bellow the level at which competition occurs between plants. However, when the plant density is too low and there is less competition between plants, yield increases.

Plots with plough + double harrow and plots with plough + harrow + ridge were significantly better in capsules characters than plots with plough alone or plough + harrow once. Good seed beds help to improve soil physical properties which in turn improve the performance of crops in terms of growth and yield. This may account for higher capsule characters observed in plots with plough + double harrow or plough + harrow + ridge. The result is in agreement with findings of Babatunde et al. (2016). They reported highest yield characters of maize in plots with plough + harrow + ridge.

Broadcasting significantly produced lower seed yield compared to drilling and spot planting. This could be due to the difficulty associated with weeding in the plot with broadcast crop compared with drilled plots where weeding was easier and more effective. This result agrees with the findings of Weiss (1971), Imoloame (2007) who showed the superiority of row planting over broadcasting in controlling weeds. Van Rheenen (1973) as well as Imoloame (2007) observed that the practice of seed broadcasting resulted in over population, which posed difficulties in weeding operations. Drilling and spot planting produced higher grain yield in both years and the combined analysis than broadcasting. The reason for this could be the inter plant competition for moisture and nutrients which could be more severe under broadcast crop compared to the drilled and spot planted crop. This agrees with the findings of Stonebridge (1963) and Imoloame (2007) who reported the superiority of row planting over broadcasting to control weeds, and that this factor alone resulted in considerable yield increases.

Plots with plough + double harrow and plots plough + harrow + ridge were significantly better in seed yields per plot and seed yield per land area than plots with either plough alone or plough + harrow once. Good seedbed helps to improve soil physical properties which in turn improves the performance of crops in term of growth and yield, which may account for higher capsule characters observed in plots with either plough + double harrow or plough + harrow + ridge. The result is in agreement with the findings of Babatunde *et al.* (2016), who reported highest yield of maize in plots with plough + harrow + ridge. Lodging percentage was highest in plots with plough + harrow + ridge compared to plots with either plough alone, plough + harrow once and plough + double harrow, which could have happened because the crops are planted on raised platform, where little wind action could possibly cause a severe damage to the crops.

CONCLUSION

From the findings of this work, it can be concluded that sesame seeds can do better when drill method of planting is used. Since there were no significant differences in the growth and yield parameters of sesame seeds with drill planting at either 25 cm or 50 cm, the lower spacing of 25 cm is recommended for the cultivation of sesame seeds in the study area and related ecologies. Plots with either plough + harrow + ridge or plough + double harrow had significantly higher growth and seed yields than plots with either plough Alone or plough + harrow once. However, lodging of sesame was highest in plots with plough + harrow + ridge compared to plots with plough + double harrow. Thus plough + double harrow is suggested as methods of seedbed preparation for sesame seeds in the study area and related ecologies. Further research should be

carried out in different ecologies to confirm the results obtained in this study.

REFERENCES

Abbas, G., Ali, M.A., Abbas, G., Azam, M, and Hussain, I. (2009). Impact of planting methods on wheat grain yield and yield contributing parameters. *Journal of Animal and Plant Science.* 19(1):30-33.

Ahuja, K.N., Lal, R.B, and Kumar, A. (1996). Effect of seed rate, date and method of sowing on growth and yield of wheat. *Annual Agricultural Research.* Write in full and italicise17(2):190-192.

Arsyid, M.A., Camacho, F.T. and Guo, P. (2009) Corn Basics: Corn Crop Management. http://www.dekalb-asia.com/pdf/CB2_CornCropManagement.pdf

Babalola T.S. (2010). Land Evaluation Studies of Two Wetland Soil in Nigeria. An MSc. thesis submitted to the Department of Crop, Soil and Environmental Sciences, University of Ado-Ekiti. pp 141.

Babatunde, I. J.; Ewulo, B. S; Agele, S. O and Ogundare, S. K. (2016). Reduced Tillage Effect on Soil Physico-Chemical Properties, Growth and Yield of Maize in Gleysol and Ultisol of Kogi State, Nigeria" . American Research Journal of Agriculture, 2: 1-11

Boguzas, V., Kairyte, A. and Jodaugiene, D. (2010). Soil physical properties and earthworms as affected by soil tillage systems, straw and green manure management. Zemdirbyste Agriculture 97(3): 3 – 14.

Carmer S.G and Swamson M.R (1973). An Evaluation of ten pairwise multiple comparisons produces by monte carlo methods. *Journal of American Statistical Association* 68(341):66-74.

Carver, M.F.F. (2005). The influence of different establishment methods on performance of early drilled winter wheat. HGCA-Project Report 375:24.

Foidl, N., Harinder P. S., Markar and Klaus Becker (2001). The potential of *Moringa oleifera* for agricultural and Industrial uses. In: The Miracle Tree Edited by Lowell J. Fuglie, Darkar, Senegal pp 45-76

Haruna, I. M. and A. Usman. (2005). Agronomic practices that enhances increased yield and seed quality of sesame (*Sesamum indicum* L.). A paper presented at the: *Agric. Transformation Day (sesame and rice) organized by OLAM Nig. Ltd.* Held at Agro Millers Ltd. Compound, Uni-Agric. Road, Makurdi, 4th Feb., 2005.

Imoloame E. O., Gworgwor N. A. and Joshua S. D. (2007). Sesame (*Sesamum indicum L.)* weed infestation, yield and yield components as influenced by sowing method and seed rate in a Sudan Savanna agro-ecology of Nigeria. African Journal of Agricultural Research Vol. 2 pp. 528-533

Khan, M.H.A., Sultana, N.A., Islam, M.N. and Zaman, M.H. (2009) Yield and Yield Contributing Characters of Sesame as Affected by Different Management Practices. *American-Eurasian Journal of Scientific Research*, **4**, 195-197.

Krezel R, Sobkowicz P (1996). The effect of sowing rates and methods on winter triticale grown on light soil. *Roczniki Nauk Rolniczych. Seria A Produkeja Roslinna,* 111(3/4):69-78.

Lal, R. (1986) Soil Surface Management in the Tropic for Intensive Land Use and High and Sustained Production. *Advance in Soil Sciences*, **5**, 102-109.

Malik, A.M., M. Farouk Saleem, Mumtaz Akhatar Cheema and Sharmin Ahmed (2003). Influence of different nitrogen levels on productivity of sesame (*Sesame indicum* iL.) under varying planting patterns. *International Journal of Agriculture and Biology* 4: 490-492.

Mayer A.M and Polijakoff-mayeber (1989). The germination of seeds, 4th (Edn) Pergamon press, oxford.

Mweso, E. (2003) Evaluating the Importance of Soil Water Availability (as a Land Quality) on Selected Rainfed Crops in Serowe Area, Botswana. http://www.itc.nl/library/Papers_2003/msc/nrm/mweso.pdfright justify

Ndarubu AA, Adejonwo KO, Adigun JA, Chezey YF (1996). Effects of wheat control treatment and inter-row spacing on growth of *Sesame indicum* L. *Nigerian Journal. of Weed Science*. 16 :15-22.

Norman, J.C. (1992): Tropical Vegetable Crops. Arthur H Stockwell Limited, London, 110-252p.

Parihar, G.N., Singh, R. (1995). Response of wheat (*Triticum aestivum*) genotypes to seed rate and sowing method under Western Rajasthan conditions. *Indian Journal. Agronomy* 40(1):97-98.

Qin, R., Stamp, P. and Richmer, W. (2006) Impact of Tillage on Maize Rooting in a Cambisol and Luvisol in Switzerland. *Soil and Tillage Research*, **85**, 50-61.

Raj, S., Singh D., Rao. V.U. (1992). Effect of date of sowing and row spacing on the yield of wheat (*Triticum aestivum* L.). *Crop Research* 5(2):199-206.

Singh KK, Jat AS, Sharma SK (2005). Improving productivity and profitability of rice (*Oryza sativa*) wheat *(Triticum aestivum)* cropping system through tillage and planting

management. Indian *Journal of Agricultural Science* 75(7):396-399.

Singh, B. and Malhi, S.S. (2006) Response of Soil Physical Properties to Tillage and Residue Management on Two Soils in a Cool Temperate Environment. *Soil and Tillage Research*, **85**, 143-153.

Stonebridge, W.C. (1963). Benniseed variety and sowing method trails. Technical Report of Institute for Agricultural Research, Northern Nigeria. 28:1-9.

Toan, D.P., Thuy-Duong, T.N.A., Carlsson, S. and Bui, T.M. (2010) Morphological Evaluation of Sesame (*Sesamum indicum* L.) Varieties from Different Origins. *Australian Journal of Crop Science*, **4**, 498-504.

Van Rheenen, A. (1973). A major problem of growing sesame in Nigeria. Agriculture University of Wagenigen, The Netherlands. A Monograph

Weiss, E.A. (1971). Castor, Sesame and Safflower Leonard Hill, London p. 443-456.

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