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Research Article

Effect of land preparation and weeding regime on the growth of sweet pepper (*capsicum annuum* l.) in Mubi, Adamawa State

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Abstract

The manner in which lands are prepared and the number of weeding times in sweet pepper farm are important factors that farmer should give desired attention. Field experiments were conducted during the 2008 and 2009 rainy seasons to determine the effects of land preparation and weeding regime on the growth of sweet pepper (*Capsicum annuum L*.). The experiments were laid out in a split plot design with land preparation: zero tilled, Ploughed, Ploughed and Harrowed. Results obtained from the experiments shows that a highly significant (P<0.01) effect of land preparation on leave count at 2WAT in 2008, stem diameter in2008, and weeds count at 2WAT in2009. Weeding regime equally showed a highly significant (P<0.01) effect on number of primary branches at 4WAT in 2009, number of secondary branches at 4WAT in2009, plant height, leave count, and stem diameter (Base and Apex). It can be concluded that land preparation has a significant effect on some growth characters of sweet pepper. The weeded three times at 2, 4 and 6WAT made a significant impact in all the growth characters studied. The raised bed method of land preparation and weeding three times at 2, 4 and 6 WAT was therefore recommended for optimum growth of pepper in the study area

Keywords: Growth, Sweet pepper, Weeding regime, Land preparation, *Capsicum annuum*

INTRODUCTION

Sweet Pepper (Capsicum annuum L.) is one of the most important vegetables that are consumed worldwide, after tomatoes and onions (Akinfasoye et al., 2006). It belongs to the family Solanaceae, and was believed to have been introduced by Columbus from the new world (Pickers gill, 1971). Sweet peppers are tender annuals or short-lived perennials herbs, with a straight woody stem at the base and up to 1.5 meters in height. Stem are branched or erect, fleshy and round or slightly angular (Tindall, 1992). They are also warm season crops that requires about the same growing condition as tomatoes and eggplant (Peet, 2006). In Nigeria, sweet pepper has beengrown for many years by peasant farmers in the northern part of the country (Olarewaju and Showemino, 2003). Nigeria is the fifth in the world pepper production (USDA, 2001) with over 630,000 metric tons (Kappeller, 1994). It is one of the most important vegetables grown in Nigeria and other parts of sub-humid and semi arid tropics (Aliyu, 2000). Sweet Pepper, an important spice crop (Alabi, 2006.) is highly cherished for its pungent flavor. Sweet pepper contributes substantially to the Nigerian diet, it is a good source of vitamins A, C (More than that obtained from tomato), E, B1, B2, and D (Muhamman and Auwalu, 2009). Also obtained from Pepper are Potassium, Phosphorus, and Calcium. Peppers are used in making vegetable curry, salad etc and as well has various medicinal values, use in the treatment of paralysis, fever etc (Gungula and Bayaso, 2005).Proper land preparation is required for optimum germination and emergence of every seed, and subsequent vigorous growth. Soil management practices such as tillage is useful in improving soil physical, chemical and biological conditions for enhanced crop performance (Peet, 2002).Farmers however; do not give

desired attention to the manner in which they prepare their lands. Indeed, the number of weeding and the time at which these weeding are done are also important factors towards achieving optimum yield. Although little is known about the best land Preparation and weeding regime, this study will try to examine the appropriate land preparation types and weeding regime to improve sweet pepper growth. Therefore, the objective of the study is to determine the appropriate type of land preparation and weeding regime for sweet pepper production in the study area.

MATERIALS AND METHODS

Study area

Mubi is located in the northern part of Adamawa state between latitude10^{o} 15'N and longitude 13^{o}16'E (Adebayo, 2004) at altitude of 696m above the sea level (Encarta, 2007), and in the northern guinea savannah belt of the Nigeria's vegetation zones. The climate of the area is characterized by alternating dry and wet seasons. The rains last from April to October with a mean annual rainfall from700mm to 1050mm (Adebayo, 2004; Udo, 1970). The land use types are mainly arable farming and livestock production (Tekwa and Usman, 2006).

Experimental design

The treatments consisted of four different land preparation methods namely: Zero tillage, Ploughed, Ploughed and harrowed, and Raised seedbed; and four weeding regime: weedy check, weeded at 2 WAT, weeded at 2 and 4WAT as well as weeded at 2, 4 and 6 WAT. The treatments were laid out using a split–plot design with three replications. Soil samples were collected and the physical and chemical properties of the soil were determined

Nursery practices

Sweet pepper seedlings were raised in seed boxes each measuring 1m x 1m, in the nursery each nursery box was filled with soil medium at appropriate mixture of 3:2:1 (Topsoil, Farm Yard Manure and River sand). Seeds were sown by broadcasting on 3rd June and 2nd May for 2008 and 2009, respectively. Seedlings were irrigated using watering cans, and were transplanted to the permanent beds at six (6) weeks after sowing. Transplanting in the plots was done when seedlings in the nursery were ready, at a spacing of 45 cm between plants and 45cm between rows (Mark, 2002).

Statistical analysis

Data collected were analyzed using Analysis of variance (ANOVA) procedure according to Gomez and Gomez (1984). Data for the two years were combined and analyzed for the growth, characters. Mean separation was made for means with significant F- test at 5% level of probability using Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

Table 1 presents the mean values for establishment count, number of primary branches and number of secondary branches of sweet pepper during the 2008 and2009 rainy seasons. There were no significant (P>0.05) variation on establishment count in the two seasons for both land preparation and weeding regime. Similarly, the combined analyses did not show any significant (P> 0.05) variation for the treatments. The non significant effect of land preparation and weeding regime on establishment count in the two seasons may be due to the vigour with which the seedlings were transplanted. Also, the aftercare given to the seedlings in the early days after transplanting could have contributed immensely in establishing the crop. This agrees with the report of Onwueme and Sinha (1999) adding that seedling vigour is an indication of the health of seedlings and the likelihood they will grow well and yield high. Similarly, the result agrees with that of Muhamman and Auwalu (2009) who reported a non-significant effect on establishment count. It was found that pepper seedlings can be raised at any time of the year provided that seedbed should be protected against rains and direct sun (Gruben and El Tahir, 2004).Number of primary branches at 4WAT did not differ from each other in 2008and in the combined seasons for both land preparations and weeding regime, but differ significantly (P< 0.01) in 2009 for weeding regime, with plots weeded 3times having 1.25 and the control plot (Zero weeding) having 0.32. However, at 10WAT,number of primary branches did not differ significantly (P> 0.05) in both 2008 and2009 for land preparation, but differ significantly (P< 0.01) higher for land preparation in the combined seasons, with zero tilled plots recording 2.59 and raised beds plots recording 4.92. The highly significant (P<0.01) effects of weeding regime on

primary branches was recorded in both 2008, 2009 and the combined seasons. The control plots had 2.07 in 2008, 1.05 in 2009 and 1.56 in the combined seasons, while the high number of primary branches of 7.27 and 5.82 was recorded on plots weeded3 times in 2008 and 2009 respectively. There were no significant (P>0.05) effect of both land preparation and weeding regime on the number of secondary branches at4WAT in 2008. Also in 2009 and in the combined years, land preparations had no significant effect (P>0.01) but weeding regimes had highly significant effect (P<0.01)in 2009, with plots weeded 3 times recording 0.40 as against the control plots (zero weeding) with 0.02. Significant (P<0.05) effect of weeding regime was also observed in the combined years for the number of secondary branches at 4WAT with plots weeded 3 times recording 0.20 while the control plot recorded 0.01. Furthermore, there was no significant (P>0.05) difference for land preparation at 10WAT for both2008, 2009 and in the combined years. However, weeding regime showed a highly significant (P< 0.01) variation in 2009 with plots weeded 3 times recording 16.10numbers of secondary branches while the control plot (Zero weeding) gave 1.20 secondary branches. Plots weeded once and twice recorded 4.00 and 9.10 secondary branches at 2 and 4 WAT respectively. There was however no significant (P>0.05) effect of weeding regimes on secondary branches in 2008 and in the combined analyses at 10WAT. The increase in the number of primary branches at 4WAT to10WAT with weeding regimes was probably due to concentration of weeds at the different levels of weeding regimes. This allows competition to set in between the weeds and the sweet pepper plants. Pepper is a poor competitor for nutrients, and water (Tindall, 1992). The increases in the number of secondary branches at 4WATto 10WAT were due to shade imposed on the pepper by weeds cover in the zero weeded plots. This did not allow pepper crop to make adequate use of available space to open up as well as use available nutrient and water. A similar reported by Fagbayide (1997) who observed that sustained moisture regimes (among others)enable pepper crop to produce better leave and branches between 4WAT and 8WAT. Table 2 presents the mean plant height of sweet pepper during the 2008 and2009 rainy seasons. There was no significant(P>0.05) effect of land preparation on the heights of sweet pepper at all the sampling periods from 2WAT to 10WAT in both2008, 2009 seasons and the combined years. Also plant heights did not differ significantly (P>0.05) for weeding regime at 2WAT and 4WAT in both 2008, 2009seasons and the combined years. However, at 6WAT, there was a significant (P<0.05) effect of weeding regime on plant height in the combined analysis, with the control plots recording 15.47 cm and the weeded 3 times recording 18.34cm. Furthermore, weeding regime showed a highly significant (P<0.01) effect on plant height at 6WATin 2009. Plots weeded once and twice recorded 17.15 cm and 18.37cm respectively, while the control plots (zero weeding) recorded 15.95 cm. The mean tallest plant of21.50 cm in that week was on plots weeded 3 times. There was also a highly significant (P<0.01) effect of weeding regime on plant height at 8WAT and 10WATin both 2009 and the combined years. Plots weeded 3 times recorded 29.60 cm and40.02 cm in 2009 at 8WAT and 10WAT, respectively. The control plots recorded16.20 cm and 26.48 cm in 2009 at 8WAT and 10WAT, respectively. There was no significant (P>0.05) effect of weeding regime at 8WAT and 10WAT, in 2008. The heights of plants remain constant at 2WAT and 4WAT, this is not unconnected with the physiological characteristic of the crop in trying to adapt to the new environment considering the variation that exist between the nursery and the permanent field. Alabi, (2006) reported that an increase in plant height from 4WAT to 12WAT may be attributed to enough rainfall which would have increased the solubility of nutrients, thus making the nutrients to be easily absorbed by the roots leading to good response up to 8WAT plant height continue to increase at a decreasing rate. This may be due to weed canopy cover which may probably interfere with the photosynthetic ability of pepper plant, especially on plots that were weeded only once, and the weedy check plots. This report contradicts the report of Fagbayide (1997) that there was no plant height increase beyond 10WAT. However, it agrees with the findings of NIHORT (1986) that moisture and nutrients availability will enhance increase in pepper plant height up to 12WAT in the Sudan savannah of Nigeria. The non significant effect of plant height in 2008 at 8WAT was not unconnected with the weed flora types experienced in the year in the weeded plots. These weeds are mostly annual grasses which do not have any serious canopy cover on the cultivated crop. The dramatic increase in plant height at 10WAT in both raised beds and the weeded 3 times plots may be as a result of regular soil turning which improves the soil condition for crop growth. It also reduces crop-weed competition during the period of growth. This appears true for both seasons for weeding regime. Aliyu *et al*. (1996) described plant growth as that of the compound interest, where growth increment in early period add to the subsequent growth of the pepper plant. Since plant height and branch numbers were high in both years, more surface area was available for photosynthesis by the pepper.

The mean values for leaf count for sweet pepper during the 2008 and 2009rainy seasons are presented in Table 3. A highly significant (P<0.01) variation exist in 2008 for land preparation at 2WAT. Ploughed plots recorded 8.55 and zero tilled plots recorded 8.22. Both ploughed and harrowed plots and raised beds plots recorded at 9.12 and 9.78 respectively. However, there was no significant (P>0.05) variation for land preparation at 2WAT in 2009 and in the combined analysis. There was also no significant (P>0.05) difference of leaf count for land preparation at 4WAT in both2008, 2009 and in the combined analysis. However, at 6WAT, significant (P<0.05) effect of land preparation was recorded on leaf count in 2008, with raised beds plots recording 62.20 while the control plots (zero tilled) recording 24.70. There was also a highly significant (P< 0.01) effect of land preparation in the combined at 6WAT.Raised beds

Table 1. The effects of land preparation and weeding regime on establishment count, number of primary branches and number of secondary branches of sweet pepper in 2008 and 2009 rainy seasons

Treatments	Establishment count			Number of primary branches						number of secondary branches					
				4WAT[1]			10WAT			4WAT			10WAT		
	2008	2009	Combined.	2008	2009	Combined.	2008	2009	Combined.	2008	2009	Combined.	2008	2009	Combined
Land preparation(LP)															
Ploughed	23.25	24.00	23.62	0.87	1.03	0.95	3.65	3.18	3.42	0.05	0.23	0.14	5.70	8.00	6.80
Plowed & harrowed	23.42	23.33	23.38	1.95	1.20	1.58	4.07	3.62	3.84	0.00	0.30	0.15	10.10	6.50	8.30
Raised Bed	23.33	22.75	23.04	1.05	0.75	0.90	5.98	3.85	4.92	0.03	0.23	0.13	50.60	13.10	31.80
Zero Tilled	22.42	21.75	22.08	0.83	0.48	0.66	3.32	1.87	2.59	0.00	0.03	0.02	4.20	2.80	3.50
Level of Significance	ns[2]	Ns	Ns	Ns	Ns	Ns	Ns	Ns	**	Ns	Ns	Ns	Ns	Ns	Ns
LSD									0.950						
Weeding Regime(WR)															
0 WAT	23.50	23.25	23.38	1.27	0.32	0.79	2.07	1.05	1.56	0.00	0.02	0.01	2.80	1.20	2.00
2 WAT	22.67	22.42	22.54	1.12	0.75	0.93	3.93	2.18	3.06	0.05	0.12	0.08	35.10	4.00	19.60
2,4 WAT	23.25	23.00	23.12	1.33	1.15	1.24	3.75	3.47	3.61	0.03	0.27	0.15	10.50	9.10	9.80
2,4,6 WAT	23.00	23.17	23.08	0.98	1.25	1.12	7.27	5.82	6.54	0.00	0.40	0.20	22.00	16.10	19.10
Level of Significance	ns	Ns	Ns	Ns	**[4]	Ns	**	**	**	Ns	**	*[3]	ns	**	ns
LSD					0.45		0.620	1.60	0.84		0.178	0.10		4.23	
LP X WR	ns	Ns	Ns	Ns	Ns	Ns	**	Ns	Ns	Ns	Ns	Ns	ns	ns	ns
LSD							1.48								

1= Weeks After Transplanting. 2=Not Significant. 3=Significant at 5% level of probability. 4= Highly significant at 1% Level of Probability

Table 2. The effects of land preparation and weeding regime on plant height of sweet pepper in 2008 and 2009 rainy Seasons

	Plant height(cm)														
Treatments	**2WAT[1]**			**4WAT**			**6WAT**			**8WAT**			**10WAT**		
	2008	**2009**	**Combined.**	**2008**	**2009**	**Combined.**	**2008**	**2009**	**Combined.**	**2008**	**2009**	**Combined.**	**2008**	**2009**	**Combined.**
Land preparation(LP)															
Ploughed	11.22	14.83	13.02	12.42	16.27	14.34	14.87	19.20	17.03	19.40	34.20	26.80	18.08	23.55	20.82
Plowed & harrowed	10.72	14.92	12.82	12.23	16.47	14.35	16.88	19.38	18.13	21.33	34.48	27.91	23.08	24.03	23.56
Raised Bed	10.40	11.87	11.13	12.27	13.43	12.85	14.78	18.12	16.45	19.23	34.48	26.86	23.78	23.72	23.75
Zero Tilled	10.37	14.07	12.22	11.83	15.08	13.46	14.37	16.27	15.32	17.62	27.18	22.40	18.63	17.47	18.05
Level of Significance	Ns[2]	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	ns	ns
LSD															
Weeding Regime(WR)															
0 WAT	10.55	14.27	12.41	12.25	15.00	13.63	14.98	15.95	15.47	18.73	26.48	22.61	21.77	16.20	18.98
2 WAT	11.02	13.82	12.42	12.52	15.35	13.93	15.63	17.15	16.39	20.38	29.98	25.18	21.42	19.00	20.21

Continuation of Table 2

2,4 WAT	11.07	13.55	12.31	12.67	14.88	13.78	15.10	18.37	16.73	17.68	33.87	25.78	17.55	23.97	20.76
2,4,6 WAT	10.07	14.05	12.06	11.32	16.02	13.67	15.18	21.50	18.34	20.78	40.02	30.40	22.85	29.60	26.22
Level of Significance	Ns	Ns	Ns	Ns	Ns	Ns	Ns	**[3]	*[4]	Ns	**	**	Ns	**	**
LSD								2.59	1.55		3.53	2.26		2.83	3.12
LP X WR	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	ns	ns
LSD															

1 = Weeks After Transplanting, 2 = Not Significant, , 3 = Highly significant at 1% Level of Probability 4 =Significant at 5% Level of Probability

Table 3. Effects of Land Preparations and weeding regime on leaf count during the 2008 and 2009 rainy seasons

Leaf count												
Treatments	**2WAT[1]**			**4WAT**			**6WAT**			**8WAT**		
	2008	**2009**	**Combined.**	**2008**	**2009**	**Combined.**	**2008**	**2009**	**Combined.**	**2008**	**2009**	**Combined.**
Land preparation(LP)												
Ploughed	8.55	13.48	11.02	15.13	15.42	15.28	34.00	33.60	33.80	40.10	36.00	38.00
Plowed & harrowed	9.12	12.82	10.97	15.80	15.12	15.46	36.70	34.80	35.70	41.50	37.30	39.40
Raised Bed	9.78	10.85	10.32	20.95	12.70	16.83	62.20	49.00	55.60	72.60	54.70	63.60
Zero Tilled	8.22	10.48	9.35	13.08	11.90	12.49	24.70	17.90	21.30	32.20	19.00	25.60
Level of Significance	**[2]	ns[3]	Ns	Ns	Ns	Ns	*[4]	Ns	**	*	*	**
LSD	0.44						14.94		8.87	16.82	11.71	9.13
Weeding Regime(WR)												
0WAT	9.22	12.33	10.78	16.83	13.42	15.13	30.80	20.60	25.70	36.90	22.00	29.50
2 WAT	8.95	12.07	10.51	15.53	13.93	14.73	39.10	26.60	32.80	46.60	29.00	37.80
2,4 WAT	8.67	10.98	9.83	15.63	12.90	14.27	40.20	36.80	38.50	47.40	40.10	43.70
2,4,6 WAT	8.83	12.25	10.54	16.97	14.88	15.93	47.50	51.20	49.40	55.50	55.90	55.70
Level of Significance	Ns	Ns	Ns	Ns	Ns	Ns	**	**	**	**	**	**
LSD							6.99	10.06	5.97	8.12	9.54	6.10
LP X WR	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	*
LSD												13.51

1 = Weeks After Transplanting, 2 = Highly significant at 1% Level of probability 3 = Not Significant, 4 =Significant at 5% Level of Probability

recorded the highest mean number of leaves with 55.60 and zero tilled plots had the least mean number of leaves of 21.30. There was no significant (P>0.05) variation for land preparation at 2, 4 and 6WAT in 2009. However, at 8WAT, significant (P<0.05) effect of land preparation was recorded on the number of leaves in 2009. Furthermore, a highly significant (P<0.01) effect of land preparation was

recorded for leaf count in the combined analyses. Ploughed plots recorded 38.00, ploughed and harrowed plots recorded 39.40, and the highest mean leaf count was observed with raised beds plots recording 63.60. The control plots (zero Tilled) recorded 25.60 numbers of leaves. Weeding regime did not significantly (P>0.05) affect leaf count at both 2WAT and 4WAT in both 2008 and 2009 and the combined seasons. However, a highly significant (P<0.01) effect of weeding regime was observed at 6WAT and 8WAT in both seasons and the combined analysis. In 2008, plots weeded 3 times recorded47.50 and 55.50, while in 2009 and the combined years, plots weeded 3 times at 2, 4 and 6WAT recorded 51.20 and 55.90 and 49.40 and 55.70 at 6WAT and 8WAT, respectively. The control plots (zero weeding) recorded 30.80 in 2008, 20.60 in 2009and 25.70 in the combined analysis, at 6WAT, and 36.90 in 2008, 22.00 in 2009, and29.50 in the combined analysis at 8WAT.

The number of leaves differed at 2WAT for land preparation in 2008, and this might not be un connected with the better soil conditions after land preparation, which remained intact for crop growth especially in the raised beds and ploughed and harrowed. This agrees with the findings of Mansoor *et al.* (2005) who reported that deep tillage effectively reduced the number of weeds (5% less) as compared to shallow tillage. The non significant increase in the number of leaves at 4WAT for both land preparation and weeding regime was probably due to the non critical period of competition for the pepper plant. Mansoor *et al.* (2005) reported that tillage practices increases moisture absorption and effectively controlled weeds, which ultimately provide favorable environment for plant growth, better root development and attainment of optimum plant population. Furthermore, it was reported by Alabi, (2006) that the number of leaves increase steadily up to 8WAT. This reveals the dramatic increase in number of leaves in both 2008 and 2009 for the raised beds and the ploughed and harrowed beds, and for plots weeded at 2 and 4 WAT and 2, 4 and 6WAT. This is not un connected with land preparation type. Raised beds provide a fine tilt for pepper growth and development. Availability of moisture and aeration in the soil must have accounted for the increase in the vegetative growth of pepper in the ploughed and harrowed plots as well as in the raised bed plots.

CONCLUSION

Based on the results obtained from this research, it can be concluded that land preparation has a significant effect on some growth characters of sweet pepper (*Capsicum annuum* L). The raised bed type produced a maximum effect in number of secondary branches at 10WAT, number of leaves, and stem diameter. The weeded three times at 2, 4 and 6WAT equally made a significant impact in all the growth characters. Furthermore, there were no interactions between land preparation and weeding regime in almost all the growth characters except stem diameter (base) in2008.

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