ISSN : 1812-5379 (Print)
ISSN : 1812-5417 (Online)
http://ansijournals.com/ja

JOURNAL OF AGRONOMY

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Journal of Agronomy 10 (2): 62-67, 2011
ISSN 1812-5379 / DOI: 10.3923/ja.2011.62.67

Effect of Land Preparation and Weeding Regime on the Yield of Sweet Pepper (*Capsicum annuum* L.) in Mubi, Adamawa State

[1]M.D. Belel, [2]M.S. Saidu and [2]A.A. Sajo
[1]Department of Agric Technology, Federal Polytechnic, Mubi, Nigeria
[2]Department of Crop Production and Horticulture, Federal University of Technology, Yola, Nigeria

Abstract: Sweet pepper farmers do not seem to give the desired attention to the manner in which they prepare their lands. An experiment to determine the effects of land preparation and weeding regime on the yield sweet pepper (*Capsicum annuum* L.) was conducted in Mubi, Nigeria during the 2008 and 2009 rainy seasons. The experiments were laid out in a split plot design with land preparation (zero tilled, Ploughed, Ploughed and Harrowed and Raised beds) assigned to the main plot. Weeding regimes at: No weeding, 2WAT (Weeks After Transplanting), 2 and 4 WAT and 2, 4 and 6WAT were assigned to the sub plots. Data were collected on yield characters such number of fruits per plot, number of fruits peer plant, fruit length, fruit diameter, yield per plot and yield per hectare. Results obtained from the experiments shows that a Land preparation was significant ($p<0.05$) for days to first flowering and fruit length. A significant ($p<0.05$) effect was also shown by land preparation yield per plot, yield per hectare, fruit length, fruit diameter, number of fruits per plant, total number of fruits per plot, fruit yield per plot and yield per hectare. The weeded three times at 2, 4 and 6WAT made a significant impact in all the yield characters studied. The raised bed method of land preparation and weeding three times at 2, 4 and 6 WAT was therefore recommended for optimum pepper yield in the study area.

Key words: Land preparation, raised bed, weeding, sweet pepper, ploughed, *Capsicum annuum*

INTRODUCTION

Sweet pepper (*Capsicum annuum* L.) also called bell pepper or pimento belongs to the family solanaceae (Olarewaju and Showemino, 2006; Kabura *et al*., 2008). It is an important vegetable crop all over the world (Peet, 2006) which ranks third in worlds vegetable cycle after tomato and onion (Akinfasoye *et al*., 2006). It is estimated that more than 7.5 million acres of capsicum are grown around the world (Peet, 2003), mostly in the tropics and sub-tropics (Aliyu, 2000) such as in Malaysia, East Africa, Central and West Africa, Carribeans and the Philippines. The crop is believed to have originated from the southern tropical America's probably in Mexico, where its domestication occurred around 2000 BC. Pepper was introduced to new world by Columbus in the fifteenth century (Gungula and Bayaso, 2005). In Nigeria, sweet pepper has been grown 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 tones (Muhamman and Auwalu, 2009).

Weeds comprise the most undesirable aggressive and troublesome elements of the world's vegetation. They are plants which grow out of their proper places and whose virtues have not yet been discovered (Kazi *et al*., 2007). Also, Shah and Khan (2006) defined it as plants whose negative values are more than their positive values. It is also considered as a plant growing at wrong place or where it is not desired (Leela, 2002).

Every seed requires a proper land preparation for optimum germination emergence 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; Hossain *et al*., 2002; Olson *et al*., 2004; Barut and Akbolat, 2005). 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, the objectives of this study was to examine the appropriate land preparation types and weeding regime to improve sweet pepper yield.

MATERIALS AND METHODS

The experiment was conducted in two years during the 2008 and 2009 rainy seasons at the Teaching and

Corresponding Author: M.D. Belel, Department of Agric Technology, Federal Polytechnic, Mubi, Nigeria

Research Farm of the Federal Polytechnic Mubi. Mubi is located in the Northeastern part of Adamawa State between latitude 9°26' and 10°10' N and longitudes 13°1' and 13°44' E (Shehu *et al*., 2007; Philip *et al*., 2010). It has a land area of 506.40 km^2 (Adebayo, 2004), at an altitude of 696 m above sea level (Encarta, 2004). The climate is characterized by alternating dry and wet season. The rains last from April to October with a mean annual rainfall from 700 mm to 1050 mm (Adebayo, 2004). The land use types are mainly arable farming and livestock production (Tekwa and Usman, 2006).

Sweet Pepper seeds, SAMARU MILD obtained from Adamawa State Agricultural Development Programme were sown by broad casting in a nursery The total land area used for the experiment was 9.5 m×29.5 m (280.25 m^2), Soil samples were collected at random at sixteen (16) different locations within the experimental area and the physical and chemical properties of the soil were determined. The site for the experiment were measured and marked out using measuring tapes and wooden pegs. Plots were first sprayed with paraquat (Gramazone®) to kill all green vegetation and later various sub plot were made for the different land preparation. Plots for Zero Tillage (ZT) were left while those to be Ploughed (P) were done using large hoes. The Ploughed and Harrowed (PH) plot was done manually using digging hoe. Raised Seedbeds (RB) were made using large hoes after deep tilling. Weeding was done using simple hoe at each weeding regime for the ploughed, ploughed and harrowed and raised beds while simple hand picking was done for the zero tilled plots. This method was adopted till the end of the experiment in the two years.

Statistical analysis: Data collected were analyzed using Analysis of Variance (ANOVA) procedure (Steel *et al*., 1997). Data for the two years were combined and analyzed for growth, yield and weed characters. Mean separation was made for means with significant F-test at 5% level of probability using Least Significant Difference (LSD) test.

RESULTS

Table 1 presents the mean values for days to first flowering and days to 50% flowering of sweet pepper during the 2008 and 2009 rainy seasons. There were no significant ($p>0.05$) effect of land preparation on days to first flowering in both seasons and the combined.

However, weeding regime differ significantly ($p<0.01$) in 2009 and the combined, but did not differ significantly ($p>0.05$) in 2008. Days to 50% flowering was significantly ($p<0.05$) different for land preparation in 2008 , with raised beds pots recording highest mean value of 26.10 days while the control plot had 8.10 days. In 2009 and the combined, there was no significant ($p>0.05$) variation in days to 50% flowering for land preparation. Weeding regime noticed a highly significant ($p<0.01$) variation in both the seasons and the combined. Plots weeded 3 times had 38.10 days while the control plot did not flower in the combined.

Fruit length: The Mean values of fruit length and fruit diameter of sweet pepper during the 2008 and 2009 rainy seasons are presented in Table 2.

Fruits length in 2008 had a significant ($p<0.05$) variation for land preparation and a highly significant ($p<0.01$) variation in the combined analysis. Both ploughed plots and ploughed and harrowed plots recorded 36.60 and 34.60 mm, respectively in the combined, while raised beds plots recorded 44.30 mm as against the 18.60 mm recorded by zero tilled plots. There was no significant ($p>0.05$) effect of land preparation on

Table 1: The effects of land preparation and weeding regime on days to first flowering and day to 50% flowering of sweet pepper in 2008 and 2009 rainy seasons

	Days to first flowering			Days to 50% flowering		
Treatments	2008	2009	Combined	2008	2009	Combined
Land preparation (LP)						
Ploughed	23.17	32.83	28.00	14.80	31.70	23.20
Plowed and harrowed	23.42	34.67	29.04	17.50	21.00	19.20
Raised bed	17.42	31.92	24.67	26.10	25.40	25.80
Zero tilled	23.33	36.50	29.92	8.10	26.40	17.20
Level of significance	Ns	Ns	Ns	*	Ns	Ns
LSD				6.94		
Weeding regime (WR)						
0 WAT	24.42	36.17	30.29	0.00	0.00	0.00
2 WAT	22.58	34.58	28.58	10.90	18.90	14.90
2,4 WAT	19.83	34.75	27.29	23.70	41.30	32.50
2,4.6 WAT	20.50	30.42	25.46	31.90	44.20	38.10
Level of significance	Ns	**	**	**	**	**
LSD		1.50	2.279	6.80	13.75	7.47
LP X WR	Ns	Ns	Ns	**	Ns	Ns
LSD				13.02		

NS: Not Significant, *: Significant at 5% Level of probability, WAT: Weeks after transplanting, **: Highly significant at 1% level of probability

Table 2: The effects of land preparation and weeding regime on fruit length, fruit diameter and stem diameter of sweet pepper in 2008 and 2009 rainy seasons

	Fruit length (mm)			Fruit diameter (mm)		
Treatments	2008	2009	Combined	2008	2009	Combined
Land preparation (LP)						
Ploughed	32.40	40.70	36.60	15.56	21.17	18.37
Plowed and harrowed	34.40	34.80	34.60	16.20	17.35	16.77
Raised bed	49.10	39.50	44.30	22.85	22.99	22.92
Zero tilled	20.60	16.70	18.60	12.31	9.77	11.04
Level of significance	*	Ns	**	Ns	Ns	*
LSD	10.18		8.57			5.17
Weeding regime (WR)						
0 WAT	11.90	0.00	6.00	5.27	0.00	2.63
2 WAT	26.30	13.80	20.00	12.72	8.00	10.36
2,4 WAT	47.70	47.20	47.50	23.83	26.19	25.01
2,4.6 WAT	50.60	70.80	60.70	25.10	37.08	31.09
Level of significance	**	**	**	**	**	**
LSD	16.80	14.58	10.84	6.91	8.46	5.32
LP X WR	Ns	Ns	Ns	Ns	Ns	Ns
LSD						

*: Significant at 5% Level of probability, NS: Not significant, **: Highly significant at 1% Level of probability

fruit length in 2009. However, weeding regime had a highly significant ($p<0.01$) effect on fruit length in 2008, 2009 and in the combined. The highest mean values recorded was in plots weeded 3 times with 50.60, 70.80 and 60.70 mm for 2008, 2009 and the combined, respectively. The least mean values noticed with zero weeded plots were 11.90, 0.00 and 6.00 mm, respectively for 2008, 2009 and the combined years.

Fruit diameter: In Table 2, fruit diameter did not differ significantly ($p>0.05$) in both 2008 and 2009 for land preparation, but differed significantly ($p<0.05$) in the combined. Raised beds plots had the highest mean value of 22.92 mm, followed by the ploughed plots (18.37 mm), and ploughed and harrowed plots (16.77 mm). The control plot (zero tilled) had the lowest diameter of 11.04 mm. Weeding regime however had a highly significant ($p<0.01$) effect on fruit diameter in both the seasons and in the combined analysis. The highest mean values of 37.08 mm was recorded by plots weeded 3 times in 2009 while the least mean value of 0.00 mm was observed with zero weeding in 2009.

Number of fruits per plant: Mean values of the number of fruits per plant, total number of fruit per plot, yield per plot and yield per hectare of sweet pepper during the 2008 and 2009 rainy seasons and the combined are presented in Table 3.

There was a significant ($p<0.05$) effect of land preparation on number of fruits per plot in both 2008 and 2009. There was also a highly significant ($p<0.01$) effect of land preparation on the number of fruits per plot in the combined analysis. Zero tilled plots recorded the least mean values of 0.40, 0.43 and 0.42 for 2008, 2009 and the combined, respectively while raised beds plots showed the highest mean value of 1.87, 1.67 and 1.62 for 2008, 2009 and the combined, respectively. Similarly, weeding regime had highly significant ($p< 0.01$) effects on number of fruits per plant in both seasons and the combined analysis. Highest mean values of 2.58 was recorded for plots weeded 3 times in 2009 while the least mean value of 0.00 was recorded for the zero weeded plots in 2009.

Total number of fruits per plot: Table 3 also presents total number of fruits per plot. This was not significantly ($p>0.05$) different for land preparation in 2008, but was highly significant ($p<0.01$) in both 2009 and the combined analysis. The lowest mean values were 2.50 (2009) and 2.12 (combined analysis). Also there was a significant ($p<0.05$) effect of weeding regimes on total number of fruits per plot in 2008 and a highly significant ($p<0.01$) effect in both 2009 and the combined. In 2008, plots weeded once had 2.00, while those weeded twice and thrice had 4.08 and 11.58, respectively. The least mean value in 2009 was with zero weeding recording 0.00 while plots weeded 3 times had 23.25.

Yield per plot (g): Yield per plot was significantly ($p<0.05$) affected by land preparation in 2008 and 2009 and highly significant ($p<0.01$) in the combined analysis (Table 3). Highest mean value was recorded for raised beds plots with 97.70 g in 2008 and 271.50 g in 2009, while 184.60 g was recorded for raised beds in the combined analysis. However, weeding regime observed a highly significant ($p<0.01$) effects on yield per plot in 2008, 2009 and in the combined years.

Yield per hectare (Tonnes): Similarly in Table 3, yield per hectare was significantly ($p>0.05$) affected by land preparation in 2008 and 2009 and highly significant ($p>0.01$) in the combined. The highest yield was recorded for raised beds plots in 2009 with 6.79 tonnes/hectare

Table 3: The effects of land preparation and weeding regime on no of fruits/plant, total number of fruits/plot, yield/plot and yield/ha of sweet pepper in 2008 and 2009 rainy seasons

	Number of fruits/plant			Total number of fruits/plot			Yield/plot (g)			Yield (tones ha^{-1})		
Treatments	2008	2009	Combined	2008	2009	Combined	2008	2009	Combined	2008	2009	Combined
Land preparation (LP)												
Ploughed	0.60	1.17	0.88	2.42	9.58	6.00	25.00	195.70	110.30	0.62	4.89	2.76
Plowed & harrowed	0.82	0.67	0.74	4.75	5.33	5.04	49.40	99.80	74.60	1.23	2.50	1.86
Raised Bed	1.87	1.67	1.62	9.08	16.50	12.79	97.70	271.50	184.60	2.44	6.79	4.62
Zero Tilled	0.40	0.43	0.42	1.75	2.50	2.12	14.40	43.50	29.00	0.36	1.09	0.72
Level of Significance	*	*	**	ns	**	**	*	*	**	*	*	**
LSD	0.57	0.37	0.81		3.29	2.17	30.75	136.3	46.39	0.77	2.48	1.16
Weeding regime (WR)												
0WAT	0.12	0.00	0.06	0.33	0.00	0.17	1.90	0.00	0.90	0.05	0.00	0.02
2 WAT	0.60	0.25	0.43	2.00	1.25	1.62	25.50	11.70	18.60	0.64	0.29	0.47
2,4 WAT	0.95	0.80	0.88	4.08	9.42	6.75	48.40	131.10	89.80	1.21	3.28	2.24
2,4.6 WAT	2.02	2.58	2.30	11.58	23.25	17.42	110.70	467.80	289.20	2.77	11.69	7.23
Level of Significance	**	**	**	**	**	**	**	**	**	**	**	**
LSD	0.41	0.45	0.30	2.41	4.02	2.28	42.54	83.70	45.71	1.06	2.09	1.14
LP X WR	Ns	Ns	*	*	**	**	Ns	**	**	Ns	**	**
LSD			0.58	5.13	7.42	4.41		165.80	98.56		4.14	2.23

*Significant at 5% Level of probability, **Highly significant at 1% Level of probability, Ns: Not significant, WAT: Weeks after transplanting

while the least yield was noticed in zero tilled plot with 0.36 tonnes/hectare in 2008. The combined analysis had 2.76 tonnes/hectare for ploughed plots, 1.86 tonnes/hectare for ploughed and harrowed plots, 4.62 tonnes/hectare for the raised beds plots and 0.72 tonnes/hectare for the control plots (zero tilled). Furthermore, weeding regime had a highly significant ($p<0.01$) effect on yield per hectare in both the seasons. Plots weeded 3 times had 2.77 tonnes/hectare, 11.69 tonnes/hectare and 7.23 tonnes per hectare in 2008, 2009 and the combined, respectively.

DISCUSSION

The non significant effect of land preparation in both the seasons on days to first flowering might also be due to the maturity and life cycle of the plant, as well as the day sensitive nature of the crop as it belongs to the night shade family. The poor cloud cover in the early days of June and July did not give enough shading to initiate reasonable flowering in the treatments. This result is in agrees with the report of Aliyu *et al.* (1996). The competitive ability of weeds flora in the less frequently weeded plots have contributed to reducing the vegetative growth of the host crop. These findings did not agree with finding of Aliyu *et al.* (1996) that delayed vegetative growth due to weeds vegetation cover will delay flowering of pepper in weedy plots. The significant effects experienced in 2009 with increased number of days to first flowering witnessed in zero weeding, also follow the same explanation as was supported by the study of Alabi (2006) who reported that the development of flowers started 6WAT and continued till 12WAT before it declined sharply.

The significant variation in the length of fruit in the first season for land preparation could be as a result of increased number of branches and leaves in the raised beds plot. The ploughed and harrowed also had a better leaves and branches thus exposing the plants for better photosynthetic opportunity. This also agree with the study of Aliyu *et al.* (1996) that enhanced photosynthetic surface as a result of leaves addition and subsequent improved physiological activities. This leads to more assimilates being produced and used for rapid increase in fruits sizes. Similarly, both fruit length and fruit diameter differed significantly in both seasons. This was principally due to less competition with weeds in the environment.

The significant effect of number of fruits per plant and total number of fruit per plot can be related to the increased number of branches. Alabi (2006) reported that the increase in the number of leaves would increase photosynthetic surfaces of plants. The current photosynthates produced would ultimately lead to the production of assimilates that will be used by the plants to increase fruit production. The weedy check plots could not yield fruits in 2009 because of the type of weed flora experienced and weed canopy which covered the pepper thus suppressing them from normal growth. This may lead to no yield, especially as pepper is a poor competitor (Leela, 2002).

Weeding done three times in these season however, resulted in a higher number of fruits on each plant. This is because of improved soil conditions, reduced weed-crop competition, adequate moisture supply and good soil aeration (Ayub *et al.*, 2003; Khattak *et al.*, 2005). Also some studies reported that primary tillage operations had a transitory influence on soil physical properties (Barzegar *et al.*, 2004a, b).

The yield of pepper per plot was significant in 2009 probably due to the increased precipitation in the later days of crop vegetative phase and a reduced intensity of

the rains during the flowering and fruiting stage. Yield of 15.13 ton ha^{-1} obtained by Alabi (2006) was a little higher than the highest result obtained in this experiment (7.23 tons ha^{-1}). This was so because of the weed population and weed flora type experienced in the experiment, as well as the problems of soil compaction in the zero tilled plots and the weedy plots (Yield per plot was significantly high in 2008, probably due to relatively low rainfall distribution during fruiting stage. This finding agreed with the report that pepper required very limited moisture and relative humidity during flowering and fruiting stages (Messiaen, 1992; Ferrara *et al*., 2011). However, Rasheed and Sola (2005) maintained that the relative good fruit yield was due to enhanced growth resulting from improved plant environment. A similar result was obtained by Ghoname and Shafeek (2005) with increased manure application.

CONCLUSION

Based on the results obtained from this research, it can be concluded that land preparation has a significant effect on some yield characters of sweet pepper (*Capsicum annuum* L). The raised bed type produced a maximum effect in fruit length, fruit diameter and number of fruits per plant, total number of fruits per plot, yield per plot and yield per hectare. The weeded three times at 2, 4 and 6 WAT equally made a significant impact in all the yield characters studied. There were significant interactions between some yield characters. There was also no interaction of the factors with any of the phenological characters. It appears that weeding of sweet pepper at 2,4 and 6 WAT would result in optimum fruit yield in the study area. Growing sweet pepper on a well prepared soil such as the raised beds will also give a higher yield in the study area. Thus, a similar research should be carried out under an irrigated condition for comparisons.

REFERENCES

Adebayo, A.A., 2004. Mubi Region: A Geographical Synthesis. 1st Edn., Paraclate Publishers, Yola, Nigeria, pp: 17-25.

Akinfasoye, I.A., D.J. Nmyan and R.M. Tairu, 2006. Effect of harvesting frequency on the duration, yield and quality of Pepper. In; proceeding of 24th conference of Hort. Society of Nigeria 17-22 Sept. Gombe.

Alabi, D.A., 2006. Effect of fertilizer phosphorous and poultry droppings treatments on growth and nutrient component of pepper (*Capsicum annum* L.). African J. Biotechnol., 5: 671-677.

Aliyu, L., 2000. The effects of organic and mineral fertilizer on growth, yield and composition of pepper. Biol. Agric. Horticult., 18: 29-36.

Aliyu, L., Y. Yusuf and M.K. Ahmed, 1996. Response of pepper (*Capsicum annuum* L.) to fertilizers: Growth, yield and yield components as affected by nitrogen and phosphorus levels. In: Proc. 14th Horton Conference, Ago-Iwoye, 1-4 April 1996.

Ayub, M., A. Tanveer, M.A. Nadeem and M. Tayyub, 2003. Fodder yield and quality of sorghum (*Sorghum bicolor* L.) as influenced by different tillage methods and seed rates. J. Agron., 2: 179-184.

Barut, Z.B. and D. Akbolat, 2005. Evaluation of conventional and conservation tillage systems for maize. J. Agron., 4: 122-126.

Barzegar, A.R., M.A. Asoodar, A.R. Eftekhar and S.J. Herbert, 2004a. Tillage effects on soil physical properties and performance of irrigated wheat and clover in semi arid region. J. Agron., 3: 237-242.

Barzegar, A.R., M.H. Mossavi, M.A. Asoodar and S.J. Herbert, 2004b. Root mass distribution of winter wheat as influenced by different tillage systems in semi arid region. J. Agron., 3: 223-228.

Encarta, 2004. Encarta premium suite: Encyclopedia. Microsoft cooperation seattle, USA.

Ferrara, A. , S. Lovelli, T. Di Tommaso and M. Perniola, 2011. Flowering, growth and fruit setting in greenhouse bell pepper under water stress. J. Agron., 10: 12-19.

Ghoname, A. and M.R. Shafeek, 2005. Growth and productivity of sweet pepper (*Capsicum annum* L.) grown in plastic house as affected by organic, mineral and bio-N-fertilisers. J. Agron., 4: 369-372.

Gungula, D.T. and I. Bayaso, 2005. The influence of nutrients and growth media on the nursery performance of sweet pepper (*Capsicum annum* L.) seedlings. J. Sustainable Dev. Agric. Environ., 1: 104-112.

Hossain, F., M.S. Bari, U.K. Majumder, M.M. Bahadur and M.J. Islam, 2002. Effect of tillage, raking and weeding on the growth, yield and economics of aus rice (cv. BR 20). J. Agron., 1: 68-70.

Kabura, B.H., B. Musa and P.E. Odo, 2008. Evaluation of the yield components and yield of onion (*Allium cepa* L.)?pepper (*Capsicum annuum* L.) intercrop in the Sudan savanna. J. Agron., 7: 88-92.

Kazi, B.R., A.H. Buriro, R.A. Kubar and A.W. Jagirani, 2007. Weed spectrum frequency and density in wheat, (*Triticum aestivum* L.) under tandojam conditions. Pak. J. Weed Sci. Res., 13: 241-246.

Khattak, M.K., M.J. Khan, M. Asrar, S. Wahab and M. Ramzan, 2005. Enhancement of wheat and yield components by controlling weeds with Deep tillage practices under irrigated clay loam soil conditions. Pak. J. Sci. Res., 11: 41-46.

Leela, D., 2002. Noxious weeds control methods. Kalyani publishers, India, pp: 81.

Messiaen, C.M., 1992. The Tropical Vegetable Garden: Principles for Improvement for and Increased Production with Application to the Main Vegetable Types. Macmillan Ltd., United Kingdom, pp: 514.

Muhamman, M.A. and B.M. Auwalu, 2009. Seedling performance of sweet pepper (*Capsicum annumm* L.) as influenced by growth media and fertilizer sources in northern guinea savanna zone of Nigeria. Biol. Environ. Sci. J. Trop., 6: 109-112.

Olarewaju, J.D and F.A. Showemino, 2006. Agronomic indices of drought tolerance in sweet pepper. Proceedings 24th Hort Conference 17-22 Sept.

Olarewaju, J.D. and F.A. Showemino, 2003. Response of pepper cultivars to nitrogen and phosphorus fertilization. Nig. J. Horticult. Sci., 8: 61-65.

Olson, K.R., S.A. Ebelhar and J.M. Lang, 2004. Impacts of conservation tillage systems on maize and soybean yields of eroded illinois soils. J. Agron., 3: 31-35.

Peet, M., 2002. Sustainable Practices for Vegetable Production in South Crop Profile Pepper. NCSU, USA.

Peet, M., 2003. Sustainable Practice for Vegetable Production in the South. North Caroline State University, USA.

Peet, M., 2006. Sustainable Practices for Vegetable Production in South Carolina Crop new profile pepper. NCSU, USA.

Philip, C.B., A.A. Sajo and K.N. Futuless, 2010. Effect of spacing and NPK fertilizer on the yield and yield components of Okra (*Abelmoschus esculentus* L.) in Mubi, Adamawa state, Nigeria. J. Agron., 9: 131-134.

Rasheed, O.A. and O. Sola, 2005. Use of sicklepod, *Senna obtusfolia* (L.) Irwin and Barneby, as mulch interplant in cayenne pepper, *Capsicum frutescens* L. Production. Emir. J. Agric. Sci., 17: 10-22.

Shah, G.M. and M.A. Khan, 2006. Check list of noxios weeds of district Mansehra, Pakistan. Pak. J. Weed Sci. Res., 12: 213-219.

Shehu, H.E., J.D. Kwari and P.M. Bzugu, 2007. An exploratory survey of soybean production as influenced by soil nutrient status in Northeastern Nigeria. J. Agron., 6: 576-580.

Steel, R.G.D., J.H. Torrie and D.A. Dickie, 1997. Principles and Procedures of Statistics: A Biometrical Approach. 3rd Edn., McGraw-Hill, New York, pp:182.

Tekwa, I.J. and B.H. Usman, 2006. Estimation of soil loss by gully erosion in Mubi Adamawa State, Nigeria. J. Environ., 1: 35-43.

USDA, 2001. Economic research services/USDA. Agriculture Outlook, April 2001. United States Department for Agriculture. http://www.ers.usda.gov/publications/agoutlook/April2001/AO280d .pdf.