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RESEARCH PAPER

Effect of surface soil removal and organic amendment on yield of sesame (*Sesamum indicum* L.)

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Abstract : An experiment was conducted to study the effect of surface soil removal and organic amendment on sesame (*Sesamum indicum* L.) during *Kharif* 2018 in the experimental field of Soil and Water Conservation department, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema campus. A split plot with three replications was designed. Surface soil removal of 0, 5 and 10 cm designated as D_0, D_1 and D_2 were carried out, respectively. The addition of different organic amendments was adopted *viz.*, O_0- control, O_1- vermicompost @ 3 tonnes ha^{-1}, O_2- poultry litter @ 3 tonnes ha^{-1} and O_3- pig manure @ 3 tonnes ha^{-1}. Seed yield was found to be significantly higher under D_0 (0.414 t ha^{-1}) whereas, D_2 recorded the lowest yield (0.380t ha^{-1}). Application of poultry manure as amendment gave significantly high seed yield (0.431 t ha^{-1}) and lowest yield was reported in O_0 (0.356 t ha^{-1}). The interaction between surface soil removal and organic amendment showed the highest yield with D_0O_2 (0.44 t ha^{-1}) and lowest with D_2O_0 (0.34 t ha^{-1}). Hence, application of organic amendments in areas where surface soil removal was done helped to improve the growth and yield of sesame.

Key Words : Sesame, Surface soil removal, Organic amendments

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INTRODUCTION

Oilseed crops are cultivated all over the world predominantly for their edible oil. *Sesamum indicum* L. is native to India and has been cultivated since time immemorial. Among all the oilseeds, the production of sesame comes in third position contributing 27 per cent of the total production in the world (Pusadkar *et al*., 2015). North Eastern India grows sesame as a minor crop on relatively poor soils, hence it has a very low yield amounting less than 5 per cent to the National pool of oilseed in the country.

Detachment of soil from the surface, transportation and displacement of this detached soil elsewhere describes the process of erosion. Water erosion accounts for 56 per cent out of the total area whereas by wind is 28 per cent (Oldeman, 1991). The most apparent damage caused by erosion is the removal of the top soil which comprises of most of the nutrients required for the plant

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to grow hence, rendering the plants to grow in the subsoil layer. Thus, this decline in topsoil depth also indicates nutrient loss, reduction of rooting depth, reduction of water and nutrient storage capacity and hence, plant productivity (Braimoh and Vlek, 2008 and Blanco-Canqui and Lal, 2008).

Manures used as soil amendment are considered very important in crop production from the stand point of fertility. Organic manure is a key fertilizer in organic and sustainable soil management. It contains many of the elements that are needed for plant growth and development. Leng (2006) attributed yield increase resulting from addition of organic manure. These amendments when used have the ability to improve the performance of crops by providing nutrients required for growth. Poultry excreta for example has abundant nitrogen compound in the form of uric (Krogdahl and Dalsgard, 1981). A project compost conducted in the University of California showed that when it comes to vermicompost acting as a soil conditioner, vermicompost is superior to traditional compost for its ability to improve soil structure and increase its water-holding capacity. The application of pig manure improved nutrient status and has the potential of sustainable crop production (Sanni and Adenubi, 2015). Keeping this in view, the present investigation was undertaken to find out the effect of simulated erosion and organic amendments on performance of sesame crop.

MATERIAL AND METHODS

A field experiment was carried out in the experimental farm of the Department of Soil and Water Conservation, School of Agricultural Sciences and Rural Development, Medziphema campus, Nagaland University from August – December 2018. The location of this institute is at $20^0$45'43"N latitude and $93^0$53'04"E longitude. It is at an altitude of 310 m above mean sea level (MSL). The climate of Medziphema is classified as humid and sub tropical. During the experimentation period the maximum weekly rainfall of 98.6 mm and the highest mean weekly temperature of 34.5ºC were both during the 3rd week upon sowing. The average humidity during the experimentation period was 95.3 per cent.

The soil texture of the experimental site was sandy loam and had an initial pH and organic carbon of 4.8 and 1.9 per cent, respectively. The available nitrogen, phosphorus and potassium content of the soil sample prior to sowing were 376.32, 21.71 and 134.40 kg ha^{-1}, respectively. Removal of the surface soil was done at depths of 0 cm, 5 cm and 10 cm whereas the application of organic amendment was done through addition of vermicompost, poultry litter and pig manure all at the rate of 3 t ha^{-1}. The spacing of the crop was kept at 30 cm × 15 cm. The total of 12 treatments laid in a split plot design with three removal depths as main plots and three organic amendments and a control as sub plots. The treatments were:

Main plots	Sub plots
D_0 – 0 cm surface soil removal	a. O_0 – Control
D_1 – 5 cm surface soil removal	b. O_1 – Vermicompost @ 3 t ha^{-1}
D_2 – 10 cm surface soil removal	c. O_2 – Poultry litter @ 3 t ha^{-1}
	d. O_3 – Pig manure @ 3 t ha^{-1}

The plant height at maturity, number of capsule, seed yield and stover yield of sesame were recorded following standard procedure and analysed statistically following the procedure outlined by Cochran and Cox (1957).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads:

Plant height:

The plant height as recorded at the time of maturity showed that the tallest plant (125.37 cm) was with 0 cm surface soil removal whereas the shortest plant (112.07 cm) was with 10 cm surface soil removal. The plant height decreased significantly with increasing depth of surface soil removal. It was found that there is a decrease of 3.96 per cent and 10.6 per cent in plant height with the removal of 5 cm and 10 cm of surface soil, respectively in comparison to 0 cm surface soil removal. This result is similar to the experiment conducted by Sur *et al*. (2008) where plant height reduced considerably due to removal of the top soil. The application of poultry litter as an amendment showed highest plant height (127.17 cm) and the shortest was in the control plot (100.87 cm). The height of the plant might have increased due to steady release of these major nutrients and this statement was similar to that made by Karim *et al*. (2016).

Number of capsule per plant:

The highest number of capsule per plant (39.07)

was recorded with no surface soil removal whereas the least capsule per plant (37.23) was with 10 cm removal of soil. The number of capsules per plants decreased by 1.0 with surface soil removal of 5 cm and 1.84 on removal of 10 cm compared to the control. These findings are in line with the reports given by Cook *et al*. (1986) who showed better plant growth at sites that were undisturbed by erosion. The highest number of capsules per plant (42.4) was with the application of poultry litter and the lowest number of capsule per plant (31.37) was recorded in control. There was also an increase in the number of capsule when applied with vermicompost (39.63) and pig manure (39.03). Similar findings were made by Mahmoud and Soliman (2017) where a mixture of organic fertilizers and soil amendments increased the number of capsules and other characters such as seed yield, number of flowers and health index of evening primrose. The increase in the number of capsules might be because of the availability of nitrogen and moderation of acid soil. Islam and Nahar (2012) also found higher yield attributes and yield with addition of vermicompost.

Seed yield:

The maximum yield (0.41 t ha^{-1}) was in the control plot and the least yield (0.38 t ha^{-1}) was found in surface soil removal of 10 cm depth. Liang *et al*. (2018) also reported a decrease of 51 per cent maize yield on removal of top soil. Chauhan and Naropongla (2009) also reported reduction in rapeseed yield with increase in erosion. Surface soil removal of 5 and 10 cm significantly decreased the seed yield by 4.88 per cent and 7.32 per cent over the control. The addition of organic amendments had a significant effect on the seed yield. Maximum seed yield (0.43 t ha^{-1}) was observed with the application of poultry litter and the lowest yield (0.36 t ha^{-1}) was in the control. Mamia *et al*. (2018) also revealed

Table 1: Effect of surface soil removal and organic amendment on plant height and number of capsules

Treatments	Plant height	Capsules
D_0 – 0 cm surface soil removal	125.37	39.07
D_1 – 5 cm surface soil removal	120.40	38.07
D_2 – 10 cm surface soil removal	112.07	37.23
S.E±	0.46	0.64
C.D. (P=0.05)	1.81	NS
O_0 – Control	100.87	31.37
O_1 – Vermicompost @ 3 t ha^{-1}	122.59	39.63
O_2 – Poultry litter @ 3 t ha^{-1}	127.17	42.47
O_3 – Pig manure @ 3 t ha^{-1}	126.48	39.03
S.E±	2.79	1.60
C.D. (P=0.05)	8.29	4.75

*NS= Non-significant

Table 2 : Effect of surface soil removal and organic amendment on seed and stover yield (t ha^{-1})

Treatments	Seed yield	Stover yield
D_0 – 0 cm surface soil removal	0.414	1.058
D_1 – 5 cm surface soil removal	0.394	1.024
D_2 – 10 cm surface soil removal	0.380	1.000
S.E±	0.005	0.003
C.D. (P=0.05)	0.019	0.010
O_0 – Control	0.356	0.964
O_1 – Vermicompost @ 3 t ha^{-1}	0.406	1.042
O_2 – Poultry litter @ 3 t ha^{-1}	0.431	1.090
O_3 – Pig manure @ 3 t ha^{-1}	0.392	1.013
S.E±	0.023	0.022
C.D. (P=0.05)	0.067	0.067

considerable increase in soybean seed yield with addition of vermicompost and poultry manure. The improvement in the seed yield might be because of accumulation of higher amount of organic matter in soil which in turn might have supplied higher amount of plant nutrients and improved the physical characteristics of the soil. These results are similar to the findings of Channabasanagowda *et al*. (2008) and Ramesh *et al*. (2008) who reported significant increase in seed yield with poultry manure and vermicompost.

Stover yield:

Maximum stover yield of sesame (1.06 t ha^{-1}) was recorded in the plot with no surface soil removal and the lowest yield (1.00 t ha^{-1}) was found with 10 cm soil removal. Stover yield decreased by 3.8 per cent and 5.7 per cent with 5 cm and 10 cm soil removal of surface soil, respectively over control. Gorji *et al*. (2008) also found that erosion had a negative effect on the dry matter and straw yield of wheat. Application of organic manure showed significant increase in stover yield. The highest stover yield (1.09 t ha^{-1}) was found on application of poultry litter and the least stover yield was in the control (0.96 t ha^{-1}). An increase of 8.3 per cent, 13.5 per cent and 5.2 per cent stover yield was observed with application of vermicompost, poultry litter and pig manure, respectively. The improvement of yield might be because of the enrichment in the nutrient availability and soil properties such as the organic matter content on application of amendments. Rachid *et al.* (2014) also reported similar findings.

Conclusion:

Plots with no surface soil removal showed taller plants, more number of capsules and significantly higher seed and stover yield compared to plots with 5 cm and 10 cm soil removal. The application of poultry litter as an amendment increased the plant height, number of capsule, seed yield and stover yield significantly compared to control as well as other amendments.

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