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EFFECT OF TILLAGE PRACTICES AND NUTRIENT SOURCES ON PERFORMANCE OF SWEET CORN

V. N. SHETYE[1]*, R. C. TIWARI[2], S. S. KADAM[3] AND U. V. MAHADKAR[4]

[1]Agronomist, Agricultural Research Station,
Phondaghat, Tal. Kankavli, Dist. Sindhudurg, (M.S.),
[2]Vice Chacellor, Mewar University, Gangrar, Chitorgarh (Raj),
[3]Ph. D. Scholar, Dept. of Agronomy, Rajasthan College of Agriculture, MPUAT, Udaipur (Rai.)
[4]Associate Dean, College of Agriculture, Dapoli- 415 712, Dist. Ratnagiri (M.S.)
(e-mail : vijayshetye68@gmail.com)

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SUMMARY

A field experiment was conducted during **rabi** seasons of 2015-16 and 2016-17 at Agronomy Farm, College of Agriculture, DBSKKV, Dapoli, Dist. Ratnagiri to study the effect of tillage practices and nutrient sources on performance of sweet corn. The experiment was laid out in split plot design with three replications assigning four tillage practices to main plots and five nutrient sources to sub plots. The results of the experiment indicated that higher value of growth attributes (plant height, number of leaves plant^{-1}, leaf area index and dry matter accumulation plant^{-1}) in green cob yield with sheath, green fodder yield and biological yield were recorded under tillage practice of one mouldboard ploughing + one pass of cultivator + one pass of rotavator (T_4). Combined application of 75% RDN through chemical fertilizer + 25% RDN through vermicompost (S_3) registered higher values of growth attribute green cob yield with sheath, green fodder yield and total biological yield.

Key words : Nutrient sources, tillage practices, sweet corn, green cob yield and green fodder yield

Now a day, considering the high cost of tillage there is a need to plan suitable tillage system for profitable crop production. Tillage also exerts adverse effects on soil when it is performed under inadequate moisture conditions, or when inadequate tillage implements are used. Excessive tillage deteriorates the soil environment. On the other hand zero tillage seriously affects the growth and establishment of plant through increased weed competition and poor physical condition. Reduced tillage has been found brightly useful in improving soil physical environment and the yield of crop without adverse effect on the environment. Since information on the comparative performance of different tillage system is limited, optimum tillage requirement for sweet corn needs to be standardized.

Beside appropriate selection of tillage practices, the improvement in average yield/ha of sweet corn can be obtained through the judicious use of nutrients. Now-a-days chemical fertilizers are quite expensive input and their usage over a long period may deplete the soil fertility, their indiscriminate usage may also cause environmental pollution problems, soil sickness, reduce the microbial activities and availability of essential nutrients and deteriorate the product quality. Therefore the search of alternative source of plant nutrients is imperative. Use of chemical fertilizers cannot be avoided but their consumption can be lowered down by using alternative sources of nutrients *i.e.* organic manures like farm yard manure, vermicompost, poultry manure and goat manure. Only one source of nutrients like chemical fertilizers, organic manures and biofertilizers cannot improve the production or maintain the production sustainability and soil health. Therefore combined use of inorganic fertilizers and organic manures is very essential. Keeping this point in the view, present field study was conducted.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* seasons of 2015-16 and 2016-17 at Agronomy Farm, College of Agriculture, DBSKKV, Dapoli, Dist. Ratnagiri. The experiment was conducted in split plot design with three replications assigning four tillage practices in plot *viz.*, one pass of rotavator (T_1), one pass of cultivator + one pass of rotavator (T_2), one mouldboard ploughing + one pass of rotavator (T_3) and one mouldboard ploughing + one pass of cultivator + one pass of rotavator (T_4) and five nutrient sources in sub plot *viz.*, 100% RDF through chemical fertilizers

(S_1), 75% RDN through chemical fertilizer + 25% RDN through FYM (S_2), 75% RDN through chemical fertilizer + 25% RDN through vermicompost (S_3), 75% RDN through chemical fertilizer + 25% RDN through poultry manure (S_4) and 75% RDN through chemical fertilizer + 25% RDN through goat manure (S_5). Sweet corn variety Sugar -75 was used as test crop. The chemical fertilizers and organic manures were applied as per treatments taking in to account the recommended dose of fertilizers *i.e.* 200: 60: 60 kg NPK ha^{-1}. The nitrogen, phosphorus and potash were supplied through urea, single super phosphate and muriate of potash, respectively. Treatment wise phosphorus and potash supplied through organic manures were first calculated and then remaining quantity of phosphorus and potash were applied through chemical fertilizers to fulfil the requirement of recommended dose of phosphorus and potash. Full dose of organic manures were applied as per treatments after the experimental layout and thoroughly mixed in the soil. Basal dose of fertilizers *i.e.* 50% nitrogen (through chemical fertilizers and organic manures) and full dose of phosphorus and potash was applied at the time of sowing. Remaining dose of nitrogen was applied in two splits *i.e.* 25% at 30 DAS and 25% at 60 DAS. Five representative plants were randomly selected from the each net plot for recording periodical biometric observations. The periodical dry matter accumulation in crop was recorded by removing two representative plants from the net plot. All the green cobs with sheath and green fodder were harvested from the net plot of each treatment to record the yield. The data of two years were pooled and analysed statistically for the interpretations of results.

RESULTS AND DISCUSSION

Effect of Tillage Practices

The data presented in Table 1 and 2 indicated that there was a remarkable influence of various tillage practices on the growth attributes, yield attributes, green cob yield with sheath, green fodder yield and biological yield of sweet corn. Tillage practice of one mouldboard ploughing + one pass of cultivator + one pass of rotavator (T_4) recorded significantly taller plants, higher number of leaves $plant^{-1}$, leaf area index, dry matter accumulation $plant^{-1}$, number of cobs $plant^{-1}$, length of cob with sheath, girt of cob with sheath, weight cob^{-1}, green cob yield with sheath, green fodder yield and biological yield over rest of the tillage practices except tillage practice T_3 for plant height and number of leaves at 30 DAS and at 60 DAS, for dry matter accumulation at all the stages of growth, girth of cob, weight cob^{-1}, and for green cob yield with sheath. This tillage practice T_4 recorded 7.77, 5.24 and 2.81 per cent higher pooled green cob yield with sheath, 10.20, 6.54 and 3.41 per cent higher pooled green fodder yield and 9.07, 5.95 and 3.14 per cent higher biological yield over tillage practices T_1, T_2 and T_3, respectively.

In general, it was observed that with every increase in level of tillage practice there was improvement in all the growth attributes, yield attributes and yield of sweet corn. This increase in values of growth attributes and yield attributes with increasing level of tillage were mainly attributed due to good tilth, loosening of soil, favourable physical condition of soil, proper aeration to roots, good atmosphere to root growth, which is responsible to more uptake of moisture and nutrient from soil and provided to the plant and retardation of weed emergence. The reason for increase in dry matter accumulation with increase in level of tillage may be traced to the significant increase in morphological parameters *i.e.* plant height, number of leaves $plant^{-1}$, leaf area index, etc. due to good tilth resulted from this tillage systems which were responsible for the more photosynthetic capacity of the plant. The higher green cob yield with sheath, green fodder yield and biological yield obtained from tillage practice T_4 may be due to significant increase in growth and yield attributes in this treatments. Yield is a function of growth and yield attributes per plant. The beneficial effect of tillage practice T_4 on growth and yield attributes of sweet corn finally enhanced the green cob yield with sheath, green fodder yield and total biological yield of the sweet corn. These results corroborate the findings of Manjith Kumar and Angadi (2014), Mishra *et al*. (2014) and Salem *et al.* (2015).

Effect of Tillage Practices

The data furnished in Table and 2 revealed that significantly taller plants, more number of leaves $plant^{-1}$, more leaf area index, dry matter production $plant^{-1}$ was observed in treatment S_3 at all the stages of crop growth over rest of the nutrient sources under study except nutrient source S_2 and S_4 at 30 DAS for plant height, except treatment S_2, S_4 and S_5 at 60 DAS for plant height, except treatment S_2 at 30 DAS for plant height, except treatment S_2 at 60 DAS and at harvest for number of leaves $plant^{-1}$and dry matter production $plant^{-1}$, except treatment S_2 at 60 DAS for leaf area index.

TABLE 1

Effect of tillage practices and nutrient sources on growth attributes of sweet corn at different growth stages (Mean of 2 years)

Treatment	Plant height (cm)			Leaves/ plant			Leaf area index			Dry matter accumulation/plant (g)		
	At 30	At 60	At harvest	At 30	At 60	At harvest	At 30	At 60	At harvest	At 30	At 60	At harvest
Tillage practices												
T_1–One pass of rotavator	11.65	79.7	173.1	5.91	8.50	10.54	0.25	2.65	3.59	2.04	68.09	157.00
T_2–One pass of cultivator + One pass of rotavator	13.07	84.4	180.2	6.32	8.67	10.77	0.30	2.75	3.73	2.14	72.15	164.23
T_3–One mouldboard ploughing + One pass of rotavator	14.47	86.2	183.8	6.57	8.91	11.03	0.33	2.92	3.92	2.19	75.85	166.80
T_4–One mouldboard ploughing + One pass of cultivator+ One pass of rotavator	14.87	88.8	192.2	6.68	9.13	11.25	0.37	3.10	4.12	2.28	76.87	173.19
S. Em±	0.28	1.25	2.50	0.10	0.08	0.06	0.005	0.027	0.033	0.03	1.15	2.14
C. D. (P=0.05)	0.88	3.85	7.71	0.29	0.24	0.20	0.016	0.083	0.102	0.09	3.55	6.58
Nutrient sources												
S_1–100% RDF through chemical fertilizers	12.33	77.5	171.2	5.98	8.36	10.53	0.26	2.55	3.57	2.04	68.38	158.31
S_2–75% RDN through chemical fertilizer + 25% RDN through FYM	14.15	87.1	185.9	6.57	9.06	11.13	0.34	3.05	3.99	2.21	75.63	167.94
S_3–75% RDN through chemical fertilizer + 25% RDN through VM	14.53	88.2	187.6	6.76	9.22	11.23	0.36	3.13	4.13	2.28	76.77	171.07
S_4–75% RDN through chemical fertilizer + 25% RDN through PM	13.59	86.4	184.3	6.37	8.81	10.91	0.32	2.86	3.82	2.17	73.50	166.19
S_5–75% RDN through chemical fertilizer + 25% RDN through GM	12.98	84.6	182.7	6.18	8.58	10.70	0.28	2.68	3.69	2.11	71.92	163.01
S. Em±	0.16	0.79	1.84	0.04	0.08	0.04	0.004	0.029	0.033	0.02	0.79	1.63
C. D. (P= 0.05)	0.45	2.22	5.21	0.11	0.22	0.11	0.010	0.082	0.093	0.06	2.22	4.61

TABLE 2

Effect of tillage practices and nutrient sources on yield attributes and yield of sweet corn (Mean of 2 years)

Treatment	Number of cobs/plant	Length of cob with sheath (cm)	Girth of cob with sheath	Weight/ cob-1	Green cob yield with sheath (q/ha)	Green fodder yield (q/ha)	Biological yield (q/ha)
Tillage practices							
T_1–One pass of rotavator	1.00	20.82	17.66	324.2	209.6	242.8	452.4
T_2–One pass of cultivator+One pass of rotavator	1.03	22.31	18.33	339.7	214.6	251.2	465.8
T_3–One mouldboard ploughing+One pass of rotavator	1.07	22.92	18.80	349.8	219.7	258.8	478.4
T_4–One mouldboard ploughing+One pass of cultivator+One pass of rotavator	1.11	24.52	19.18	355.0	225.8	267.6	493.4
S. Em±	0.011	0.36	0.20	3.44	2.04	2.39	2.88
C. D. (P=0.05)	0.035	1.11	0.63	10.59	6.28	7.37	8.88
Nutrient sources							
S_1–100% RDF through chemical fertilizers	1.00	20.75	17.29	324.5	209.0	245.1	454.1
S_2–75% RDN through chemical fertilizer+25% RDN through FYM	1.09	23.51	19.12	353.6	225.3	259.6	484.8
S_3–75% RDN through chemical fertilizer+25% RDN through VM	1.13	24.09	19.59	361.2	226.9	261.9	488.8
S_4–75% RDN through chemical fertilizer+25% RDN through PM	1.04	22.67	18.54	341.7	213.7	256.7	470.3
S_5–75% RDN through chemical fertilizer+25% RDN through GM	1.01	22.18	17.94	329.8	212.2	252.2	464.5
S. Em±	0.010	0.21	0.19	3.50	0.57	1.05	1.25
C. D. (P=0.05)	0.028	0.58	0.52	9.88	1.62	2.97	3.53

The sweet corn grown with combined application of 75% RDN through chemical fertilizers + 25% RDN through vermicompost (S_3) proved significantly superior over rest of the nutrient sources in respect of all the yield attributes and yield. However it was statistically similar with combined application of 75% RDN through chemical fertilizers + 25% RDN through FYM (S_2) for length of cob with sheath, girth of cob with sheath, weight cob^{-1} with sheath, green cob yield with sheath and green fodder yield. Use of nutrient source S_3 registered 8.54, 6.89, 6.16 and 0.71 per cent higher pooled green cob yield with sheath, 6.86, 3.83, 2.04 and 0.90 per cent higher green fodder yield and 7.63, 5.23, 3.92 and 0.81 per cent higher total biological yield over nutrient sources S_1, S_5, S_4 and S_2, respectively.

Combined application of 75% RDN through chemical fertilizer + 25% RDN through vermicompost proved superior in recording higher values of growth and yield attributes over the rest of the nutrient sources. This might be due to the slow release of nutrients through the vermicompost for longer period, increased absorption and utilization of nitrogen. Vermicompost have the optimum range of pH improved soil physical conditions, which enhances the availability of most of the nutrients for the proper growth and development of crop. Thus, balanced nutrition under favorable nutrient environment might have resulted in better root development, which in turn encouraged vigorous growth parameters and yield attributes and ultimately the yield. The results of present investigation are in conformity with the results reported by Keerthi *et al.* (2013) and Rasool *et al.* (2015).

Interaction effects of tillage practices and nutrient sources

An interpretation of data (Table 3 and 4) shows that interaction of tillage practice T_4 with nutrient sources S_3 recorded significantly highest green cob yield with sheath and biological yield that rest of the interactions except interactions T_4S_2, T_3S_3 and T_3S_2 for green cob yield with sheath and interaction T_3S_3 on pooled basis for total biological yield. This significant enhancement in yield performance under interaction of tillage practice T_4 with nutrient sources S_3 was associated with better performance of certain growth parameters (Table 1) and yield attributes (Table 2). Similar findings were reported by Yadav (2010) and Memon *et al.* (2013).

TABLE 3

Interaction effect of the tillage practices and nutrient sources on green cob yield with sheath of sweet corn (Mean of 2 years)

Treatments	Green cob yield with sheath (q/ha)			
	T_1	T_2	T_3	T_4
S_1	203.4	206.1	212.1	214.5
S_2	216.3	222.1	226.4	236.3
S_3	217.0	223.2	230.1	237.2
S_4	205.9	211.2	215.1	222.6
S_5	205.3	210.4	214.7	218.7
Same tillage practice for	S. Em±	1.14		
different nutrient sources	C. D. (P=0.05)	3.23		
Same nutrient source for	S. Em±	4.84		
different tillage practices	C. D. (P=0.05)	11.66		

TABLE 4

Interaction effect of the tillage practices and nutrient sources on biological yield of sweet corn (Mean of 2 years)

Treatments	Biological yield (q/ha)			
	T_1	T_2	T_3	T_4
S_1	441.0	447.8	459.3	468.3
S_2	462.0	476.5	490.5	510.4
S_3	464.5	480.1	495.4	515.0
S_4	449.0	463.9	476.4	492.0
S_5	445.5	460.5	470.5	481.5
Same tillage practice for	S. Em±	2.50		
different nutrient sources	C. D. (P=0.05)	7.07		
Same nutrient source for	S. Em±	7.35		
different tillage practices	C. D. (P=0.05)	20.76		

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