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Research Notes

Tillage requirements of soybean based cropping systems

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Soil physical constraints affecting the retention and movement of soil moisture, soil aeration, soil nutrient movement, soil temperature, seed germination, seedling establishment and root proliferation have been well documented (Ghildyal and Gupta, 1991). Even judicious application of all the required plant nutrients at times fails to yield good results due to poor soil physical environment. Poor soil tilth lowers the infiltration and percolation rates, nutrient movement and free air transport within the soil profile and the contribution of soil fertility to crop growth is hampered (Larsen *et al.* 1994).

Tillage also mixes and incorporates organic debris into the soil. Enhanced respiration and microbial biomass turn over are often observed soon after tillage (Reicosky and Lindstom, 1993). Dick (1983) observed that mechanical incorporation of fertilizer within root zone is not possible with zero tillage. Rajkannan *et al.* (2001) studied the effect of tillage practices on physical properties in a sorghum-groundnut cropping system and reported that pod yield of groundnut was influenced significantly by different tillage methods. With this background the present experiment was conducted to find out the effect of different tillage practices on yield of soybean-sorghum and soybean-sunflower cropping systems.

The experiments were conducted for two years during *kharif* seasons of 2000 and 2001 in a site located at 11°N latitude and 77°E longitude at an altitude of 426.7m above sea level. The soil of the experimental field is clay loam in texture, classified under typic haplustalf. The fertility status of the soil is classified as low in available N (224 kg ha^{-1}), medium in available P (14.2 kg ha^{-1}) and high in available K (675 kg ha^{-1}). The treatments consisted of three tillage methods (zero tillage, minimum tillage and conventional tillage) and two cropping systems (soybean-sunflower and soybean-sorghum), which were replicated thrice and laid out in split plot design.

Treatments :

Main plots :

M_1 - Zero tillage

M_2 - Minimal tillage (ploughing with cultivator/ country plough-twice)

M_3 - Conventional tillage (ploughing with disc-once and with cultivator-twice)

Sub-plots :

S_1 - Soybean (*kharif*) - Sunflower (rabi)

S_2 - Soybean (*kharif*) - Sorghum (rabi)

The layout was fixed and tillage treatments were given to both the crops. For zero tillage treatments glyphosate was sprayed at 2.0 kg/ ha.

The different methods of tillage had remarkable effect on germination percentage of soybean during both the years studied. Conventional method registered significantly higher germination of soybean over zero tillage but was on par with the minimum tillage during *kharif* 2001. However in *kharif* 2000 conventional tillage was significantly superior over the other two methods. The preceding crops failed to have any effect on germination of soybean.

The tillage methods failed to significantly influence the plant population. The plant population was also not affected by the preceding crops of either sunflower or sorghum. The number of pods per plant was not influenced significantly by the methods of tillage and by the preceding crops during *kharif* 2000. Hence the grain yield was also not influenced by the treatments. During *kharif* 2001 adoption of conventional tillage registered higher number of pods per plant, which was on par with minimal tillage and

Table 1. Effect of tillage and cropping system on growth parameters of soybean during *kharif* 2000 and 2001

Treament	Germination (%)		Population (000 ha^{-1})		Pods per plant		Grain yield (kg ha^{-1})		Soybean grain equivalent yield (kg ha^{-1})		Net returns (Rs ha^{-1})		BC Ratio	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Main plots														
Zero tillage	83.7	79.5	232.15	262.75	86.8	85.5	1286	1311	1149	1083	6130	2734	1.38	1.33
Minimum tillage	83.7	87.7	231.46	284.97	86.5	87.9	1299	1400	1148	1156	7138	3991	1.46	1.52
Conventional tillage	86.3	88.3	235.39	287.75	86.1	90.9	1316	1499	1151	1252	6037	4352	1.38	1.53
SEd	0.412	0.745	1.793	5.871	0.496	1.294	29.96	13.16	9.61	13.51	-	-	-	-
CD (P=0.05)	1.144	2.069	NS	16.30	NS	3.594	NS	36.55	NS	37.49	-	-	-	-
Sub plots														
Soybean - Sunflower	83.2	86.0	230.36	283.31	86.3	90.0	1294	1444	1328	1388	8049	5782	2.93	1.71
Soybean - Sorghum	85.9	84.3	235.46	273.68	86.3	86.3	1307	1362	970	940	4821	1603	2.59	1.20
SEd	0.572	1.347	2.422	4.814	0.533	0.638	13.09	14.74	24.69	33.31	-	-	-	-
CD (P=0.05)	2.456	NS	NS	20.71	NS	2.745	NS	63.45	110.5	143.3	-	-	-	-

both these two methods produced significantl higher number of pods than zero tillage. Sunflowe was found to be better preceding crop an lead to significantly higher number of pod over sorghum. Soybean grain yield was significantl higher under conventional tillage, which wa followed by minimal tillage. Sunflower a preceding crop resulted in significantly highe soybean yield over sorghum.

The grain equivalent yield was significantl higher through adoption of conventional tillag over minimal tillage and these two method were significantly superior to zero tillage. Durin *kharif* 2000, significant influence was not observe During both the years, sunflower as precedin crop registered significantly higher soybea equivalent yield over sorghum. During *khar* 2000, the net returns and BC ratio were high through adoption of minimal tillage but durin kharif 2001 higher net returns and BC rat were registered with conventional tillage. Durin both the years, sunflower grown as precedi crop registered higher net returns and BC rat than growing sorghum as preceding crop.

Conventional tillage produced significant higher grain yield of sorghum as compar to other methods tillage. Among the croppi systems studied, sunflower followed by soybe recorded significantly higher soybean grain yie over the preceding crop of sorghum.

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