

## Short Communication

### Effect of Tillage on Yield and Moisture Use Efficiency of Clusterbean in Arid Zone

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The light soils require comparatively lesser tillage than heavier soils (Venkateswarlu, 1981). Excessive tillage on light sandy soils may be detrimental for sustainable agriculture in the arid regions due to wind erosion hazard (Gupta and Gupta, 1981). On the other hand, plough plant system results in greater weed growth. Nearly 80% of the farmers in arid zone use tractor for tillage and planting of dryland crops. The implement used for this operation is cultivator. In many instances, farmers carry out ploughing and planting with cultivator in a single operation adopting plough plant system. In some areas cross tillage using cultivator is practised and crops are planted with second operation. Deep ploughing with disc plough is also done in some situations, particularly on fields having fallow in rotations. It is obvious that farmer's wisdom needs to be paid due attention in developing appropriate technologies to facilitate their adoption. Keeping this in view, an investigation on tillage requirement of clusterbean [*Cyamopsis tetragonoloba* (Linn.) Taub.] in arid region was undertaken.

Field experiment was conducted during Kharif 1993 at Central Arid Zone Research Institute, Jodhpur (latitude 26.30° N, longitude 73.02° E). The treatments consisted of three type of plough plantings having tynes at (a) 22.5 cm spacing, (b) 45 cm spacing and

(c) 22.5 cm spacing but planting in alternate rows i.e., 45 cm; (d) planting after cross cultivation with cultivator having tynes at 22.5 cm spacing but planting in alternate rows; (e) single disk harrowing; (f) cross disk harrowing, and (g) disk ploughing. These seven treatments, in triplicate, were laid out in a Randomised Block Design. The soil was coarse loamy, mixed hyperthermic, camborthids and contained 80.9% sand, 7.08% silt and 11.9% clay (International pipette method). The soil had 0.22 % organic carbon, 0.027% total nitrogen, 16 kg ha<sup>-1</sup> available P and 225 kg ha<sup>-1</sup> available K. The moisture contents at field capacity and -15 bar tension were equivalent to 10.5% and 3.4% water content (w/w), respectively. The bulk density of surface 25 cm soil was 1.5 Mg m<sup>-3</sup>. The moisture at sowing in 100 cm soil profile was 5.31 cm and the rainfall during cropping period was 188 mm. Weekly soil moisture balance in profile during cropping season was recorded to determine water use and water-use efficiency.

Grain and straw yields were influenced significantly by different tillage treatments (Table 1). Grain yield of clusterbean under planting with cultivator at 22.5 cm spacing (farmers' practice) was significantly lower than harrowing treatments. Grain yield under planting in alternate rows with cultivator tynes spaced at 22.5 cm (modified farmers' practice)

Table 1. Effect of different tillage practices on clusterbean yield, yield attributes and water-use efficiency

Treatment	Grain yield (kg ha <sup>-1</sup> )	Straw yield (kg ha <sup>-1</sup> )	Pods plant <sup>-1</sup>	Grains pod <sup>-1</sup>	1000 grain weight (g)	Plant height (cm)	Water use (mm)	WUE (kg ha <sup>-1</sup> cm <sup>-1</sup> )
Plough plant with cultivator having tynes at								
a. 22.5 cm	404	2265	12.0	6.7	30.1	52.4	178	22.6
b. 45.0 cm	374	2122	15.6	7.0	30.7	54.0	175	21.4
c. 22.5 cm but planting in alternate row	453	2390	16.8	7.6	31.7	55.3	190	23.7
d. Cross cultivation with tynes at 22.5 cm but planting in alternate row	509	2458	17.1	7.7	31.5	55.7	184	27.3
e. Disc harrow (single)	530	2384	19.0	7.7	32.2	55.0	189	28.0
f. Disc harrow (cross)	558	2735	19.4	7.8	31.9	55.3	185	30.2
g. Disc ploughing	426	2278	15.1	6.7	30.4	55.6	185	22.9
CD at 5%	110	276	3.6	NS	NS	NS	-	-

was equivalent to that of harrowing treatments. The plant growth was poor in plough plant treatment due to greater competition with early weed growth which adversely influenced the crop yield. Significantly higher number of pods plant<sup>-1</sup> (19.0 - 19.4) under harrowing treatments was responsible for better yields under these treatments compared to plough plant method. Gupta (1987) also reported

that one disking with harrow significantly increased grain yield of cowpea compared to no tillage. In modified farmers' practice, inner row tillage at the time of sowing resulted in less weed and better plant growth due to more space for root and shoot development, which increased grain yield over the farmers' practice. The total water use (Table 1) in harrowing treatment was more (185 mm) than

Table 2. Per cent soil moisture extraction under different tillage practices

Treatment	Soil layer (cm)				
	0-20	20-40	40-60	60-80	80-100
Plough plant with cultivator having tynes at					
a. 22.5 cm	41.0	26.2	13.5	10.7	8.6
b. 45.0 cm	43.6	24.6	12.9	10.7	8.2
c. 22.5 cm but planting in alternate row	40.8	25.2	14.1	11.9	9.0
d. Cross cultivation with tynes at 22.5 cm but planting in alternate row	37.0	25.0	14.5	12.3	11.2
e. Disc harrow (single)	40.0	25.5	12.7	11.5	10.3
f. Disc harrow (cross)	38.8	24.4	14.2	12.2	10.4
g. Disc ploughing	41.2	23.4	15.3	9.7	10.4

plough plant system (178 mm). Most of the water (60 - 65%) was extracted from the upper 40 cm soil profile (Table 2). The moisture depletion pattern indicated that under harrowing, disc ploughing and cross cultivation it was relatively more from deeper layers (20 - 100 cm) while in plough plant method the moisture extraction was greater from the surface layer (0-20 cm). This indicated that the increased tillage allowed better availability of moisture in deeper layers. Mukesh Chand et al. (1993) also reported that deep tillage by disc harrow resulted in better pulverization of the soil facilitating better and deep root development in rainfed mustard thereby increasing soil moisture extraction. WUE of clusterbean varied between 20 and 30 kg

ha<sup>-1</sup> cm<sup>-1</sup>, with the maximum under disc harrowing (30.2 kg ha<sup>-1</sup> cm<sup>-1</sup>) followed by modified farmers' practice (27 kg ha<sup>-1</sup> cm<sup>-1</sup>).

### References

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