Annals of Arid Zone 32 (4) 271–272 1993

Effect of In-situ Moisture Conservation Practices and Fertilizer on Root Development of Mustard

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Mustard is predominantly a dry land crop and grown in *rabi* on conserved moisture. In addition to soil moisture and nutrients, root development is also responsible for higher production of crops in the drylands. More number and depth of roots are referred to utilize available moisture from different layers of soil which consequently affect the yield of crops. Since there is a lack of information on characterisics of root system of mustard in dry land areas, present study was undertaken.

The present investigations on the root system of mustard variety 'Vaibhav' were conducted at Soil Conservation and Water Management farm of CS Azad University of Agriculture and Technology, Kanpur, during *Rabi* of 1988-89 and 1989-90. The treatment comprised of 24 combinations of water harvesting and moisutre conservation practices (Table 1), in main plots, while two levels of mulching and two levels of fertility in the sub-plots. The design of layout was split plot with 3 replications. The plot size was 5.4 x 4.5 m.

The surface (0-25 cm) soil of the experimental field was sandy loam having field capacity 19.37% and bulk density 1.48 g cm^{-3}. Chemical properties of surface soil are OC 0.20%, available P 8.6 kg ha^{-1}, available K 225 kg ha^{-1}, and pH 7.5. The sowing was done on 28 September 1988 and 5 October 1989 and was harvested on 22 February 1989 and 16 February 1990, respectively. Crop was given 2 mulching levels and 2 fertility levels viz., unmulched (control) and

Table 1 *Effect of in-situ moisture conservation practice and fertilizer on root development of mustard (mean of 2 years, 1988-89 and 1989-90)*

Treatments		Vertical expansion (cm)	Weight (g) 0–5 cm	5–15 cm	15–30 cm	Total weight (g)	No. of roots $plant^{-1}$ Primary	Secondary
Water harvesting and moisture conservation practices								
Contour sowing (control)	C_1	44.6	3.4	7.7	6.0	17.2	19.4	423.3
Intercepted earth bund	C_2	48.3	3.6	8.2	6.4	18.2	19.4	479.7
Vegetative bund of *Leucaena leucocephala*	C_3	51.6	3.9	8.7	6.8	19.4	19.8	540.8
Trenching	C_4	55.1	4.0	9.0	7.0	20.0	18.6	612.8
Ridge and Furrow	C_5	57.9	4.3	9.7	7.6	21.6	20.9	632.9
Ridge and Furrow + Vegetative bund	C_6	64.2	4.1	10.5	8.0	22.6	21.7	660.0
Mulching								
Unmulched	M_0	52.8	3.9	8.9	6.9	19.8	19.6	552.2
Mulched (@ 3.0 t ha^{-1})	M_1	54.9	4.0	9.0	7.0	20.1	20.8	569.6
Fertility levels								
Unfertilized	F_0	52.4	3.9	8.9	6.9	19.8	18.9	545.6
Fertilized ($N_{40} + P_{20}$ ha^{-1})	F_1	55.4	4.0	9.0	7.0	20.1	21.8	576.2

mulched 3.0 t ha^{-1} paddy straw mulch and unfertilized (control) and fertilized @ 40 kg N + 20 kg P ha^{-1}. Depth of root penetration was measured in the field while other observations (Table 1) were recorded in the laboratory.

Root study was made at harvest by randomly selecting 3 plants from each plots and in one replication only. A trench of about 30 cm width and 25 cm away from the plant shoot either side, up to a depth of 1 m was dug. Adhered soil was removed with the help of fine Jet of water. By this method 95% roots of each plant was recovered. When all roots are completely exposed, they were taken out and washed in running water, while keeping them on a sieve. The observation regarding vertical expansion, total weight and number of primary and secondary roots were taken.

Effect of water havesting and moisutre conservation practices

Data presented in Table 1 revealed that C_5 and C_3 exhibited the most extensive deep root system, maximum root weight and more number of primary and secondary roots per plant.

Ridge and furrow + vegetative bund (C_6) showed roots at more depth and highest total weight, number of primary and secondary roots over control followed by ridge and furrow, trenching, vegetaive bunding, intercepted earth bund and contour sowing. Weight of root was maximum in 5-15 cm and minimum in 0-5 cm soil layers.

Effect of mulching

Application of mulch markedly improved the depth and extensiveness of the roots. It was observed that application of mulch increased the depth of root, weight of root and number of primary and secondry root $plant^{-1}$ over control. Since application of mulch increased root penetration to deeper depth in the soil, resulted not only increased number but weight of roots $plant^{-1}$ (Table 1). It is in conformity with the results obtained by Bhan (1974) and Bhan (1976). Ridge and furrow increased the weight of roots at of 5-15 cm depth of soil layer by 0.12% over control.

Effect of fertilization

Application of fertiliziers exhibited marked increase in depth of roots, weight of root (0.25% $plant^{-1}$) and number of primary and secondary roots over control (unfertilized). Application of fertilizer increase the growth rate of roots which consequently increase the availability of nutrients and ultimately increased the total weight of roots, number of roots as well the depth of roots. These results are in accordance with those of Sheshadri *et al.* (1958) Bhan and Mishra (1970), Sahrawat (1989) and Kuchen buch *et al.* (1989).

References

Bhan Suraj 1974 Dry farming problems and Research in Uttar Pradesh. *World Crops* **26 (2)** 73-74

Bhan Suraj 1976 Root development and moisture use of rainfed brown Sarson as influenced by agronomic practices. *Indian Jorunal of Agronomy* **21 (3)** 245-248

Bhan Suraj & Mishra DK 1978 Effects of variety, spacing and soil fertility on root development in groundnut under arid conditions. *Indian Journal of Agricultural Sciences* **40 (2)** 1050-1055

Kuchan buch Rolf, Wolfgang weigelt & Johanes Jung 1989 Modification of root-shoot ratio of sunflower (*Helianthus annus* L.) by nitrogen supply and a triazole - type plant growth regulator. *Biological Abstract* **87(9)** 14

Sahrawat K L 1989 Effects of nitrogen on growth, and nitrogen and phosphorus uptake in tops and root of sorghum gorwn in an Alfisol and a *Vertisol. Biological Abstract 87(5) AB-6*

Sheshadri GR, Rao B M & Muhamed V 1958 Studies on root development in groundnut. *Indian Journal of Agricultural Sciences* **28** 211-215

(Received May 1992 Accepted October 1993)