

Intercropping for better stability in crop production in dryland watersheds

S. P. MULIK, S. M. MORE, S. S. DESHPANDE AND J. D. PATIL

*Dry Farming Research Station, Mahatma Phule Krishi Vidyapeeth, Solapur,
Maharashtra 413 002*

Received: February 1992

ABSTRACT

An experiment was conducted during 1989-91 on the association of pigeonpea [*Cajanus cajan* (L.) Millsp.] as an intercrop in sunflower (*Helianthus annuus* L.) and pearl millet [*Pennisetum glaucum* (L.) Br. emend. Stuntz] in 2 : 1 row proportion in dryland watershed under farmers, management practices. The highest monetary returns (Rs 5,723/ha), land-equivalent ratio (1.23) and benefit : cost ratio (1.24) were obtained in the intercropping system of sunflower + pigeonpea in 2 : 1 row proportion. The intercropping of pearl millet + pigeonpea in 2 : 1 row proportion was found productive but not economical (Rs 3,743/ha). The sole cropping of sunflower and pigeonpea gave Rs 4,736 and Rs 4,699/ha monetary returns respectively.

It is well known that the crop production is unstable and at times uneconomic due to vagaries of monsoon in dryland areas of scarcity zone of Maharashtra. The principal rainy (*kharif*)-season crops, viz. pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz] and sunflower (*Helianthus annuus* L.), grown as sole crops at times are found to be rather risky due to delayed monsoon accompanied with prolonged intermittent breaks in the rainfall. A strategy for stabilizing the production of dryland crops through commonly recognized practice of intercropping of compatible cross is considered viable to overcome the situation. The system is aimed at increasing productivity per unit area and it guarantees insurance against total crop failure, particularly under aberrant weather conditions. Umrani *et al.* (1987) and Patil and Patil (1989) reported beneficial effects

of principal *kharif* legume, viz. pigeonpea [*Cajanus cajan* (L.) Millsp.] with pearl millet or sunflower.

In order to demonstrate the impact of combination of short-duration cereal or oilseed with long-duration pulse as an intercrop to the farming community, the present study was conducted at farmers' fields at the Operational Research Project, Sasure (Solapur).

MATERIALS AND METHODS

The field verification trials were conducted on the farmers' fields under the Operational Research Project, Sasure, during 1989-1991. The number of farmers were treated as replications. The verification trials were conducted with 4 farmers every year. The sunflower ('Morden' and 'SS 56') and pearl millet ('MH 169') were tried as base crops and pigeonpea ('BDN 2') as an

intercrop in 2 : 1 row proportion along with the sole crops of sunflower, pearl millet and pigeonpea. The plot size was 2,000 m². The recommended fertilizer schedule was adopted for the sole and intercropping. Sunflower and pearl millet either in sole or intercropping system was fertilized with 50 kg N and 25 kg P₂O₅ kg/ha. Sole pigeonpea was fertilized with 12.5 kg N and 25 kg P₂O₅. The row spacing for sole crop of sunflower, pearl millet and of pigeonpea and intercropping of sunflower + pigeonpea in 2 : 1 row proportion was 45 cm, whereas for pearl millet + pigeonpea in 2 : 1 was 30 cm. The soils was deficient in nitrogen (organic carbon 0.17–0.49%), low to medium in phosphorus (4–18 kg/ha) and ample in potash (100–135 kg/ha). The soil pH was 7.5–8.5 and electrical conductivity was less than 0.29 dS/m.

During 1989, the total rainfall received was only 412.5 mm in 25 rainy days, and the sowing was completed in the second fortnight of July. The rains received in August helped for better establishment of crops. However, due to dry spell in the later period the sunflower crop was adversely affected, while the rains received in September were useful for pearl millet and pigeonpea.

Contrary to this the situation, the total rainfall received during 1990 was 572.2 mm in 38 rainy days. The sowing was completed in time in June. However, 2 long-dry spells of 46 and 39 days during June–August and August–September adversely affected the growth and yield of the rainy-season (*kharif*) crops.

The year 1991 was almost a drought year having total rainfall of 218 mm in 25 rainy days. The sowing was completed in the first fortnight of July. Long-dry spell of 49 days from 31 July to 17 September adversely

affected the growth of *kharif* crops, resulting in poor yields of crops.

RESULTS AND DISCUSSION

Yield of crops

The total yield obtained under the intercropping was higher or almost equal to that of sole cropping. In sunflower + pigeonpea cropping system the pigeonpea was benefitted on sole-crop area basis. Such beneficial effects were also noticed by Borse and Kulkarni (1988). As a result of intercropping with pulse, the enhancement in yield of cereal or oilseed crop was attributed to many reasons, such as efficient utilization of available soil moisture, suppression of weed growth, no-competition for nitrogen (which is often the most limiting resource) and enhanced availability of N to the non-legume base crop (Singh and Joshi, 1980; Muthuvel *et al.*, 1984). The association of pearl millet + pigeonpea was productive during the partial drought also. Similarly, the sunflower + pigeonpea intercropping was found stable during the adverse effect of the season. Thus, the component crops are able to complement each other for making better utilization of the available resources. Venkateswarlu (1985) reported that short-duration sunflower and long-duration pigeonpea a better combination.

The pigeonpea-seed yield was less under pigeonpea + pearl millet intercropping than sunflower + pigeonpea intercropping system during all the years. This may probably be due to the dominance of pure crop of pearl millet. Suppression of pigeonpea due to competitive effect of pearl millet was also observed by Umrani (1981).

Gross monetary returns

The gross monetary returns were significantly higher in the sunflower +

Table 1. Grain and fodder yield (q/ha), monetary returns, land-equivalent ratio and benefit: cost ratio as influenced by different crops and cropping systems during 1989-91

Treatment	Average yield (q/ha)			Gross monetary returns (Rs/ha)			Land-equivalent ratio			Benefit: cost ratio		
	1989	1990	1991	Mean	1989	1990	1991	Mean	1989	1990	1991	Mean
<i>Sole cropping</i>												
Sunflower	5.66 (-)	3.65 (-)	6.44 (-)	5.25 (-)	2,831	3,653	7,725	4,736	1.00	1.00	1.00	1.00
Pearl millet	11.78 (26.20)	5.95 (19.65)	6.31 (16.91)	8.01 (20.92)	3,212	1,979	3,265	2,819	1.00	1.00	1.00	1.00
Pigeonpea	6.22 (16.30)	4.00 (14.35)	5.44 (17.54)	5.22 (16.06)	4,061	4,159	5,879	4,700	1.00	1.00	1.00	1.00
<i>Intercropping (2:1)</i>												
Sunflower	2.79 (-)	3.20 (-)	3.84 (-)	3.28 (-)	4,084	5,648	7,438	5,723	1.18	1.44	1.08	1.23
Pigeonpea	4.10 (11.50)	2.25 (12.40)	2.63 (7.98)	2.99 (10.63)								
<i>Intercropping (2:1)</i>												
Pearl millet	10.77 (23.80)	4.20 (15.20)	2.76 (7.14)	5.91 (15.38)	4,937	3,274	3,019	3,743	1.42	1.12	0.71	1.08
Pigeonpea	2.98 (8.50)	1.65 (11.05)	1.48 (4.73)	2.04 (8.09)								
CD (P = 0.05)					802.28	NS	2,557.31	1,100.64	0.213	0.077	0.134	

Market rate (Rs/q): Sunflower grain 500, 1,000 and 1,200; pearl millet grain 250, 250 and 450; pearl millet straw 10, 25 and 25; pigeonpea grain 600, 950 and 1,000; and pigeonpea straw 20, 25 and 25 in 1989, 1990 and 1991 respectively

pigeonpea (2 : 1) (Rs 5,723/ha) than the intercropping of pearl millet + pigeonpea (2 : 1) and sole pearl millet, when the data were pooled. The sole sunflower (Rs 4,736/ha) and sole pigeonpea (Rs 4,700/ha) were found to be the next best crops.

On the basis of these observations, the intercropping of pearl millet + pigeonpea and sole pearl millet were productive, but were not economically viable practices compared with sunflower + pigeonpea intercropping (2 : 1) or sole sunflower and sole pigeonpea.

Land-equivalent ratio

In general, the yield advantage was higher with sunflower + pigeonpea (land-equivalent ratio 1.23) than pearl millet + pigeonpea (1.08) intercropping, mainly due to the better yield of sunflower in the intercropping system. The intercropping of pearl millet + pigeonpea showed less yield advantage due to the poor yield of pearl millet in the intercropping system. The maximum yield advantage was observed during 1990 for sunflower + pigeonpea cropping system (1.44). Similar results were also reported by Umrani *et al.* (1987) and Borse and Kulkarni (1988). Further, the yield stability was observed to be less in intercropping of pearl millet + pigeonpea. This may be due to the adverse season and competitive effect of pigeonpea. The highest yield benefit (1.42) was observed during 1989, whereas the lowest (0.71) during 1991.

Benefit : cost ratio

The mean benefit : cost ratio for the intercropping of sunflower + pigeonpea (2 : 1) was maximum (1.24) and was followed by the sole pigeonpea (1.23). Similarly, it is important to note that the lowest benefit : cost ratio was observed in sole pearl millet cropping system.

REFERENCES

- Borse, C. D. and Kulkarni, S. D. 1988. 'Studies on intercropping of sunflower and pigeonpea under dryland conditions.' Paper presented at *National Symposium on Recent Advances in Dryland Agriculture*, held at Central Research Institute for Dryland Agriculture, Hyderabad, during 13-16 September 1988.
- Muthuvel, P., Subramanian, V., Robinson, J. C. and Ravikumar V. 1984. Soil fertility and crop yield under bajra + pulse intercropping. *Madras Agricultural Journal* 71 (8) : 623-624.
- Patil, C. B. and Patil, B. R. 1989. Studies on cereal legume association as intercrop in pearl millet with different legumes under dryland conditions. *Indian Journal of Dryland Agricultural Research and Development* 4 (1) : 37-42.
- Singh, P. and Joshi, N. L. 1980. Intercropping of pearl millet in arid areas. *Indian Journal of Agricultural Sciences* 50 (4) : 538-541.
- Umrani, N. K. 1981. Intercropping of higher production of pulses. *Indian Farming* 31 (9) : 13-14.
- Umrani, N. K., Patil, C. B. and Chavan, K. B. 1987. Effects of row proportions on sunflower-pigeonpea intercropping. *Indian Journal of Agricultural Sciences* 57 (7) : 468-71.
- Venkateswarlu, J. 1985. Sunflower-crop management (*In* *Management of Dryland Crops*, 271 pp. Balsubramanian, V. and Venkateswarlu, J. Central Research Institute for Dryland Agriculture, Hyderabad, Andhra Pradesh.