region is better since the variation is very low. Though the Yanam region is the most efficient cropping zone, the CV is higher indicating the higher fluctuation.

By introducing recent technologies for rice including hybrid rice in these regions, there is a greater scope for further increasing the yield.

In Mahe though the RYI is medium, but the area under rice is very low and hence it is not an efficient zone for rice cultivation. The probable reason for such a situation might be due to unfavourable weather condition.

Thus it can be concluded that Yanam, Pondicherry and Karaikal region of the UT are potential areas for rice cultivation.

References

Kanwar, J. (1972). Cropping patterns, scope and concept. *In*: Symp. on cropping pattern in India, ICAR, New Delhi, p.11-39.

Veeraputhiran, R., Sudhakar, G., Sankaranarayan, K. and Balasubramanian, T.N. (2000). Identification of efficient groundnut cropping zone for Tamil Nadu. *Madras Agric. J.* 87: 337-339.

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Research Notes

Optimization of safflower production under resource constraints

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For increasing the production of crop, the use of different components such as application of fertilizers, thinning, plant protection measures and weed control are the major components. Farmers are neglecting the application of fertilizers, use of plant protection measure and weed control due to paucity of funds and lack of knowledge. No data are available on this aspect that how much is reduction in yield due to individual or in combination of these factors. The present investigation was therefore, undertaken on medium deep black soils under dry land conditions (Patil *et al.* 1981), to gather the information on these factors.

The field experiment was conducted at All India Co-ordinated Research Project on oilseeds (Safflower). Solapur, Maharashtra (India) during three years *viz.* 1996-97, 1998-99 and 1999-2000 in rabi season. The soil type was medium deep black having pH 7.8, organic carbon 0.2 per cent and available nitrogen, phosphorus and potassium 135.0, 7.5 and 635 kg ha^{-1}, respectively. The experiment was conducted using recommended doses of fertilizers (50:25:0 NPK, respectively). There are total eight treatment combinations and three replications. The details of treatment were 1) Full package, *i.e.* T_1, 2) $T_2 = (T_1$ - Fertilizers), 3) $T_3 = (T_1$ - Thinning), 4) $T_4 = (T_1$ - Plant Protection), 5) $T_5 = (T_1$ - Weed control), 6) $= T_6$ (T_1 - Fertilizer + Plant protection), 7) $T_7 = (T_1$ - Weed control + Thinning), 8) $T_8 = (T_1$ - (Fertilizer + Plant protection + Weed control + Thinning)).

The gross plot size was 3.60 x 5.00 m^2 and net plot size was 2.70 x 3.80 m^2. The experiment was laid out in randomized block design. The observations were recorded for seed yield, gross returns and net returns (Table 1).

Effect on Seed yield

The full package significantly influenced the seed yield in all the three years of experimentation and the same was reflected in the pooled analysis. The increase in seed yield with full package practice over the absolute

Table 1. Effect of various factors on seed yield and economics in safflower

Treatment details	Seed yield (kg ha^{-1})			Pooled mean kg ha^{-1}	Gross returns Rs ha^{-1}	Net returns Rs ha^{-1}
	1996-1997	1998-1999	1999-2000			
Full package (T1)	1924 (159.5)	757 (166.0)	1333 (179.6)	1338 (166.8)	14555	9318
T_1 - No fertilizers	1285 (106.5)	593 (130.0)	1053 (141.9)	977 (121.8)	10654	6373
T_2 - No thinning	1217 (100.9)	660 (144.7)	1096 (147.7)	991 (123.6)	10844	5775
T_3 - No plant protection	1530 (126.8)	650 (142.5)	796 (107.3)	992 (123.7)	10849	6145
T_4 - No weed control	1643 (136.2)	663 (145.4)	817 (110.1)	1041 (129.8)	11372	6422
T_5 - No fertilizer + No plant protection	1330 (110.3)	408 (89.5)	798 (107.5)	845 (105.4)	9147	5398
T_6 - No weed control + No thinning	1665 (138.1)	570 (125.0)	802 (108.1)	1009 (125.8)	10978	6196
T_7 - No fertilizer + No plant protection + No weed control + No thinning	1206	456	742	802	8725	4997
General mean	1474	594	930	999	10895	6413
SE ± /ha	86	58	48	38		
CD at 5% level	261	175	146	110		
C.V%	10.1	16.8	9.0	11.3		

(Figure in parentheses indicate the percentage increase over the absolute control *i.e.* T_8)

control (T_8) was 159.5, 166. 0 and 179.6 per cent in 1996-97, 1998-99 and 1999-2000 respectively. Similar results were also observed by Reddy *et al.* (1986) and Patil (1987), in safflower and also by Saini and Dhillon (1985), in groundnut.

Pooled data of three years showed that the treatment T_8 *i.e.* no use of fertilizers, plant protection, weed control and thinning gave the lowest seed yield (802 kg ha^{-1}), while the full package treatment was significantly superior to all the treatments (1338 kg ha^{-1}) for seed yield. The treatment of no fertilizer + no plant protection gave significantly lowest seed yield (845 kg ha^{-1}) over all the treatments except treatment T_8 which indicates that no use of fertilizers along with non following of the plant protection measures proved to be crucial in reducing the seed yield in safflower crop.

Gross Returns

Highest grass returns of Rs.14555 ha^{-1} was observed in full package treatment (T1) followed by the treatment of T_5 *i.e.* - No weed control. However lowest gross return was recorded in treatment T_8 *i.e.* Rs. 8725 ha^{-1}.

Significantly highest net returns were obtained by practice of full package (Rs. 9318 ha^{-1}) over all treatments. Lowest net return Rs. 4997 ha^{-1} was recorded by treatment T_8. However, absence of single constraint did not differ significantly.

Thus it may be concluded from this study that the omission of the recommended practices in safflower lowers down the seed yield significantly. Hence, for getting maximum seed yield all the recommended practices have to be followed.

References

Patil N.D., Umrani, N.K., Shende, S.A., Manke, B.S., Kale, S.P. and Shingte, A.K. (1981). Improved crop production technology for drought prone areas of Maharashtra. *Technical Bulletin*, 1: pp.61.

Patil P.S. (1987). Safflower book published by Mahatma Phule Agril. University Zonal Research Station, Solapur, M.S. pp.23.

Reddy Y.Y.R. (1986). Economics of recommended practices for oilseed crops in dry land farming *J. Oilseeds Resh.* 3: 51-59.

Saini J.S. and Dhillon, A.S. (1985). Yield and quality of groundnut - as affected by some production factors. *J. Oilseeds*, 2: 50-56.

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Research Notes

Influence of cereal-legume, legume-cereal and cereal-cereal sequences on productivity, economics and soil fertility status

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Continuous cropping of cereal-cereal sequence has declining effects on crop productivity and nutrient status of the soil in the long run. Inclusion of legumes in a cropping system helps in improving the soil fertility, which results in higher yield of the succeeding crops as compared to preceding exhaustive cereal or non-legume. Similarly incorporation of green manures not only substitutes the -fertilizer N requirement of the crops but also improves the fertility status of the soil (Mahapatra *et al.* 2002). The productivity and net return of cropping sequences increase with effective and economic utilization of residual and commutative carry over effect of nutrients. In Chhattisgarh, rice-fallow is the most prevailing cropping system which has more than 60 per cent fallow land during rabi. Secondly, lathyrus taken in rice fields as a relay crop to exploit residual moisture and nutrients, has very poor crop stand and productivity. Therefore, there is a thrust for evaluating the effect of different systems consisting common legumes and green manures with non-legume crops of the region. Keeping these in view, an experiment was designed and conducted with the objectives to compare the productivity and economics of different systems and monitor the changes in soil fertility status as influenced by legume-cereal, cereal legume and cereal-cereal sequences with special attention to green manuring.

The experiment was conducted at IGAU, Raipur under hot sub humid climate during *kharif* and *rabi* season of 2000-01 and 2001-02 in a silty clay loam soil with a pH of 6.80, EC of 0.20 dSm^{-1}, organic carbon 0.46 per cent, available N 224, available P_2O_5 13 and available K_2O 242 kg ha^{-1}. The total rainfall received by the system from June to May was 822 and 960 mm respectively for two years. The experiment was laid out in RBD with four replications with a net plot area of 7.0 x 9.0 m. The treatments consisted four cropping sequences *viz.* rice-wheat, rice-chickpea, rice-wheat-green manuring (Dhaincha) and soybean-wheat with different fertilizer levels. Test crops were rice (Var. Mahamaya), soybean (Var. PK-472) in *kharif* and wheat (Var. Sujata) and chickpea (Var. JG - 74) in rabi respectively. The recommended dose of fertilizer (RDF) for rice, soybean, wheat and chickpea were 120:80:60;