Table 3. Economics (Benefit - cost ratio)

Irrigatiion schedule \ Mulching	No mulch	Raw coconut coir pith	Sugarcane trash	Plastic mulch	Mean
0.45 IW/CPE	1.49	1.42	1.26	0.97	1.29
0.60 IW/CPE	1.28	1.31	1.46	1.12	1.29
0.75 IW/CPE	1.16	1.73	1.20	1.00	1.27
Mean	1.31	1.49	1.31	1.03	-

Among the irrigation levels, 0.45 and 0.6 IW/CPE ratio recorded the highest benefit cost (BC) ratio of 1.29 each. In the case of mulching, raw coconut coir pith registered the highest BC ratio of 1.49.

From this experiment, it could be concluded that application of raw coconut coir pith @ 12.5 t ha^{-1} and adoption of the irrigation schedule of 0.45 IW/CPE would be efficient and economically viable technology for perennial redgram BSR 1 cultivation.

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Research Notes

Quality of Sunflower *(Helianthus annuus* L) seed as influenced by recycled organic manure from the livestock components

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Sunflower responds well to applied fertilizers (Tomar *et al*., 1997). Information pertaining to integrated nutrient management (INM) with inorganics and organics on sunflower quality is lacking. Hence a field experiment was carried out at farmers field, at *Chinnamathampalayam village*, Periyanayakanpalayam block in Coimbatore district, Tamil Nadu, India during Adipattam (July-Aug) of 2004. The farm is situated in the Western agro-climatic zone of Tamil Nadu at 11 °N latitude, 77° E longitude and at an altitude of 426.7 m above MSL. The soil of the experimental field was sandy loam in texture (Typic Ustochrepts). The soil

Table 1. Quality attributes of sunflower as influenced by recycled organic manure through IFS components

	*Oil content (%)	Oil yield (kg ha^{-1})	*Crude protein content (%)	Crude protein yield (kg ha^{-1})
T_1 : 100% RDF (40: 20: 20 kg N: P_2O_5: K_2O ha^{-1})	34.1	415	16.0	804
T_2 : 100 % RDF + FYM 12.5 t ha^{-1}	39.0	581	18.9	1139
T_3 : 100 % RDF + 2.91 ha^{-1} AOM from IFS components	36.5	497	17.5	958
T_4 : 75 % RDF + 2.91 ha^{-1} AOM from IFS components	36.4	482	17.3	939
T_5 : 50 % RDF + 2.91 ha^{-1} AOM from IFS components	36.2	473	17.2	925
T_6 : 100 % RDF + 5.81 ha^{-1} AOM from IFS components	39.3	625	20.1	1263
T_7 : 75 % RDF + 5.81 ha^{-1} AOM from IFS components	38.9	567	18.8	1117
T_8 : 50 % RDF + 5.81 ha^{-1} AOM from IFS components	38.7	550	18.7	1090
SEd	-	23.6	-	77
CD (P=0.05%)	-	47.1	-	35

* Data not statistically analyzed

RDF : Recommended dose of fertilizer
FYM : Farm yard manure
AOM : Available organic manure
IFS : Integrated farming system

was characterized as low in organic carbon (0.53 %), low in available nitrogen (160.0 kg ha^{-1}), medium in available phosphorus (14.5kg ha^{-1}) and medium in available potassium (185.0 kg ha^{-1}) with pH and EC of 7.92 and 0.74 dS m^{-1}, respectively. Sunflower variety was CO 4 (85 days). Livestock components included in integrated farming system (IFS) were Jersey cows (2 milch-cow + 1 calf), goat (10 female + 1 male) and Guinea fowl (20 Nos) for one hectare unit.

The voids produced by livestock components were collected daily and quantity of manure produced was worked out for one year as 5.8 t on dry weight basis. The treatments were 100 per cent recommended dose of NPK (40: 20: 20 kg N:P_2O_5: K_2O ha^{-1}) hereafter referred as 100% RDF, 100% RDF + FYM (12.5 t ha^{-1}), 100, 75 and 50% RDF (40: 20: 20, 30:15:15 and 20:10:10 kg N: P_2O_5: K_2O ha^{-1}) along with 100 and 50% Available Organic Manure (5.8 and 2.9 t ha^{-1}) from IFS components, which is hereunder used simply as AOM.

Application of 40: 20: 20 kg N: P_2O_5: K_2O ha^{-1} + 5.8 t ha^{-1} AOM from IFS components recorded higher oil content (39.3%) and oil yield (625 kg ha^{-1}) followed by 100%

RDF+ FYM 12.5 t $ha^{-1}$and 30: 15: 15 kg N: P_2O_5: K_2O ha^{-1} + 5.8 t ha^{-1} AOM from IFS components, respectively. The lowest oil content and oil yield was observed with 40: 20: 20 kg N: P_2O_5: K_2O ha^{-1} without FYM or AOM (Table 1). Organic manures obtained from the livestock components of IFS not only provide major nutrients, but also micronutrients like S, Mn and Zn *etc.*, (Guar, 1980) may be the cause for oil content and oil yield.

Crude protein content and crude protein yield were increased by organic and inorganic fertilizer application (Table 1). Among different treatment combinations, 40: 20: 20 kg N: P_2O_5: K_2O ha^{-1} + 5.8 t ha^{-1} AOM resulted in higher crude protein content (20.1%) and crude protein yield (1263 kg ha^{-1}) and it was found to be superior than other treatments. Applying 40: 20: 20 kg N: P_2O_5: K_2O ha^{-1} + FYM 12.5 t ha^{-1} or 30: 15: 15 kg N: P_2O_5: K_2O ha^{-1} + 5.8 t ha^{-1} AOM were also found to enhance the protein yield. The lowest crude protein content and crude protein yield was observed when only chemical fertilizer applied (40: 20: 20 kg N: P_2O_5: K_2O ha^{-1}) without the combination of FYM or AOM.

The increase in crude protein content might be due to higher supply of N through the combined application fertilizers along with organic manures. Application of 100% RDF + FYM 15 t ha^{-1} resulted in the highest crude protein percentage (20.04%) than control plot (19.0%) in sunflower crop as reported by Laxminarayana (2004). The crude protein yield was significantly higher due to integration of organics with inorganic. Sililar reports were available elsewhere (Devidayal and Agarwal, 1998).

Based on the experimental results, it could be concluded that the application of 40:20:20 kg N: P_2O_5: K_2O ha^{-1} in combination with AOM a combination of cow+goat+guinea fowl voids collected from the livestock components could ensure higher quality sunflower seed. The quantity obtained from the animal unit of the farm measured 5.8 t ha^{-1} only but the quantity influenced better than 12.5t FYM.

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