

Assessing the method of application of farmyard manure on dryland crops

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ABSTRACT

A study was carried out during the rainy seasons of 1994–2000 to assess the method of application of farmyard manure (FYM) on dryland crops. Application of FYM, on an average, increased the seed yield of sorghum [*Sorghum bicolor* (L.) Moench], sunflower (*Helianthus annuus* L.), castor (*Ricinus communis* L.) and pigeonpea [*Cajanus cajan* (L.) Millsp.] by 27, 23, 36 and 30% respectively, compared, to the recommended dose of chemical fertilizer. Use of FYM in set row application gained 20, 13, 19, 19% yield increase in sorghum, sunflower, castor and pigeonpea, respectively, over broadcasting and incorporation.

Key words : Organic amendment, FYM, Set rows and Broadcasting

The adverse effect of moisture stress on productivity of rainfed crops can be minimized by the use of organic manures as soil amendments. These amendments conserve not only the soil moisture but also supply nutrients. Advantage of applying farmyard manure (FYM) has already been established, while in this context an application of FYM to specific site continuously has any advantage in dryland needs to be confirmed instead of spreading over the whole farm. However, the advantage of spreading may not entirely reflect in the final yield but in terms of soil health also, needs to be measured. Hence a study was undertaken to assess the effect of method of application of FYM, i.e., in set and non-set rows (broadcasting).

MATERIALS AND METHODS

A field experiment was conducted during the rainy (*khari*) seasons of 1994–2000 in the rainfed Alfisols of the CRIDA Farm, Hayathnagar. Treatments were FYM @ 10 tonnes/ha/year in set and non-set rows (broadcasting) with sorghum, sunflower, castor and pigeonpea as test crops and were compared with the recommended dose of chemical fertilizer (50, 30, 0). The experiment was laid out in randomized block design with 5 replications. The crop varieties were sorghum 'CSH 9', sunflower 'MSFH 8', castor 'GCH 4' and pigeonpea 'PRG 100' for 7 years from 1994 to 2000. All these crops were rotated in all the years.

Formation of set rows

Plant rows were set at 60 cm inter-row spacing and were continued to maintain at same location for all the years. All the inputs were applied to these rows only and

sowing of crops were restricted to the slope of the bund.

The FYM was applied @ 10 tonnes/ha/year in set and non-set rows and incorporated and compared with the recommended chemical fertilizer for the last 7 years.

Soil was sandy loam in texture, low in available N (210 kg/ha), phosphorus (10 kg/ha) and medium to high in available potassium (210 kg/ha). The initial organic carbon (%) was 0.51 and 0.53 at 0–15 and 15–30 cm soil depth, while pH was 6.0 and 6.2 at these depths. The experiment was laid out studied in randomized block design with 5 replications. The yields of crops in various treatments were recorded in all the years to evaluate the response of the various crops. Seed and stalk yields were recorded and gross returns were calculated.

RESULTS AND DISCUSSION

Seed yield of rainfed crops

Application of farmyard manure (FYM), on an average, increased the seed yield of sorghum, sunflower, castor, pigeonpea by 27, 23, 36 and 30%, respectively, compared to the recommended dose of chemical fertilizer (Table 1). Among the methods of application, on an average, set row application of FYM showed slight yield increase in all rainfed crops under study than broadcasting and incorporation. Hence use of FYM in set row application gained 20, 13, 19, 19% yield increase in sorghum, sunflower, castor and pigeonpea, respectively, over broadcasting and incorporation. The yield was 2,090, 1,020, 1,252 and 788 kg/ha respectively. The increment in sorghum seed yield with FYM in set row application is attributed to increase in growth components, also the N uptake which resulted due to efficient use of rainfall. The crops showed different re-

Table 1. Effect of methods of application of farmyard manure on yields of dryland crops

Treatment	Seed yield (kg/ha)							Mean
	1994	1995	1996	1997	1998	1999	2000	
<i>Sorghum</i>								
FYM (10 tonnes/ha/year) SR	1,301	778	4,025	2,558	2,242	3,950	2,623	2,497
FYM (10 tonnes/ha/year) NSR	1,268	730	4,014	1,413	1,802	3,138	2,266	2,090
RDF	1,339	633	3,628	1,015	1,519	2,516	1,988	1,805
CD (P=0.05)	NS	NS	160	118	412	683	109	370
<i>Pigeonpea</i>								
FYM (10 tonnes/ha/year) SR	486	610	2,257	1,443	861	427	474	937
FYM (10 tonnes/ha/year) NSR	438	602	1,899	1,024	799	404	351	788
RDF	371	492	1,650	929	616	346	232	662
CD (P=0.05)	62	95	270	114	NS	43	56	131
<i>Castor</i>								
FYM (10 tonnes/ha/year) SR	657	1,162	1,858	1,534	2,463	1,693	1,056	1,492
FYM (10 tonnes/ha/year) NSR	899	904	1,658	1,470	1,837	1,186	809	1,252
RDF	876	484	1,293	1,097	1,679	975	653	1,008
CD (P=0.05)	NS	152	183	160	480	363	199	222
<i>Sunflower</i>								
FYM (10 tonnes/ha/year) SR		678	1,853	1,052	1,463	1,064	969	1,147
FYM (10 tonnes/ha/year) NSR		563	1,675	691	1,065	1,267	860	1,020
RDF		690	1,695	641	853	636	750	878
CD (P=0.05)		NS	136	157	146	245	60	190

SR, Set rows; NSR, non-set rows (broadcasting); RDF, recommended dose of fertilizer

Table 2. Effect of methods of application of farmyard on straw or stalk or fodder yield (kg/ha) of dryland crops

Treatment	1994	1995	1996	1997	1998	1999	2000	Mean
<i>Sorghum</i>								
FYM (10 tonnes/ha/year) SR	2,362	1,412	7,239	4,655	11,780	6,562	6,685	5,821
FYM (10 tonnes/ha/year) NSR	2,302	1,325	7,309	3,711	11,070	6,510	6,404	5,519
RDF	2,431	1,149	6,588	3,646	10,290	6,250	5,718	5,153
CD (P=0.05)	NS	114	401	559	NS	NS	460	355
<i>Pigeonpea</i>								
FYM (10 tonnes/ha/year) SR	1,283	2,105	5,958	3,820	6,250	3,333	4,011	3,823
FYM (10 tonnes/ha/year) NSR	1,156	2,072	5,013	2,951	5,208	2,916	3,799	3,302
RDF	976	1,962	4,356	2,170	5,078	2,395	3,572	2,930
CD (P=0.05)	190	NS	762	550	818	468	303	379
<i>Castor</i>								
FYM (10 tonnes/ha/year) SR	1,982	2,161	3,455	2,864	3,385	1,250	2,584	2,526
FYM (10 tonnes/ha/year) NSR	1,672	1,681	3,083	2,799	3,255	1,041	2,121	2,236
RDF	1,629	900	2,032	1,953	2,474	729	1,517	1,605
CD (P=0.05)	490	540	750	253	481	360	120	314
<i>Sunflower</i>								
FYM (10 tonnes/ha/year) SR		454	1,760	1,009	1,758	1,666	1,247	1,315
FYM (10 tonnes/ha/year) NSR		534	1,594	781	1,750	1,458	1,020	1,189
RDF		655	1,610	651	1,172	677	984	958
CD (P=0.05)		201	117	192	200	355	53	NS

sponse to FYM. The response of cereal to FYM application was highest (489 kg/ha), followed by the castor crop (364 kg/ha), and pulse as well as sunflower responded similarly (201 kg/ha) to FYM application. This confirms the finding of Singh (1999), who reported higher grain, straw yield and N uptake in wheat with FYM. Thus FYM application not only served to use rainfall efficiently but also served as a source of nutrients in increasing growth and yield of rainfed crops. Higher seed and oil yields in sunflower with FYM was also reported by Singh and Bansal (1999) and Mathews and Stewart (1982).

During 1994–2000, FYM (irrespective of method of application) outyielded the chemical fertilizer by around 489, 206, 364 and 201 kg sorghum, sunflower, castor and pigeonpea seed respectively. This indicates that though the chemical fertilizer has shown an increase initially over a period of 7 years of evaluation, its harmful effect not only decreased the yields but also affected the soil health over time.

Response of dryland crop to method of farmyard manure application

Highest difference in mean seed yields over 7 years of experimentation due to the method of application was observed in sorghum (407 kg/ha), followed by castor with 240 kg/ha, and the response of pulse and sunflower was almost similar with 149 and 127 kg/ha respectively. Maximum response was observed with sorghum, it is highly responsive to organic manure application and still responsive to the set row application also. In initial years recorded increase in yield with the recommended doses of nutrients through chemical fertilizer.

Effect of farmyard manure on N uptake and gross returns

The improvement in productivity of sorghum, sunflower, castor, pigeonpea resulted in significant increase in gross returns to an extent of 29, 41, 35 and 31% respectively, with the application of FYM over respective recommended doses of fertilizers. Further, set row application of FYM was proved to be economically viable compared to broadcasting and incorporation (non-set row) method owing to significantly higher returns of about 17, 40, 26, 20%, respectively, for sorghum, sunflower, castor and pigeonpea (Table 3 and Fig. 1).

Influence of farmyard manure on soil parameters

Continuous application of nutrients in the form of chemical fertilizer alone reduced organic carbon, N content and water-holding capacity of soil over base level of soil productivity. The results are in confirmation with the findings of Anandswarup (1999). Ravi Kumar and

Table 3. Effect of methods of application of farmyard manure on gross returns, net returns and ratio of different field crops (mean of 6 years)

Crop	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit : cost ratio
<i>Sorghum</i>			
FYM (10 tonnes/ha/year) SR	7,863	4,963	1.71
FYM (10 tonnes/ha/year) NSR	6,719	3,919	1.40
RDF	5,664	3,164	1.27
<i>Pigeonpea</i>			
FYM (10 tonnes/ha/year) SR	15,765	12,365	3.64
FYM (10 tonnes/ha/year) NSR	12,709	9,409	2.85
RDF	10,834	7,834	2.61
<i>Castor</i>			
FYM (10 tonnes/ha/year) SR	13,644	9,444	2.44
FYM (10 tonnes/ha/year) NSR	11,380	7,280	1.92
RDF	9,529	5,729	1.51
<i>Sunflower</i>			
FYM (10 tonnes/ha/year) SR	17,786	13,886	3.56
FYM (10 tonnes/ha/year) NSR	13,556	9,756	2.57
RDF	10,806	7,306	2.09

Krishnamoorthy (1980) and Patter *et al.* (1999) reported increase in organic carbon, nitrogen and phosphorus with FYM application. Continuous application of FYM had very little or no effect on P level over initial fertility level (Table 4).

With continuous application of FYM in set rows, water-holding capacity of soil at 0–15 cm depth was increased by 8.5% and the response was not conspicuous at 15–30 cm soil depth. Organic carbon (%) was reduced in case of continuous application of chemical fertilizers at both the soil depths. However, the organic carbon increase was about 5.7% with FYM set rows at 15–30 cm soil depth, while it was 5.9% at top-soil depth of 0–15 cm. However, the increase was around 2.9% on an average with broadcasting of FYM (Table 4).

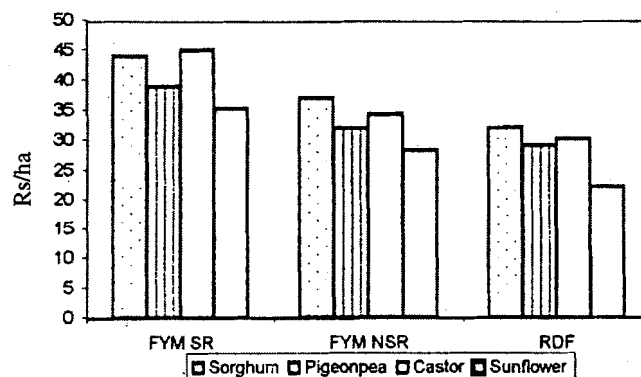


Fig. 1. Effect of methods of farmyard manure application on nitrogen uptake of dryland crops

Table 4. Influence of soil amendments and their methods of application on soil parameters

Parameter	Soil depth (cm)	Initial status	After 2000		
			Chemical fertilizers	FYM-set rows	FYM-non-set rows
<i>Physical parameter</i>					
Water-holding capacity (%)	0-15	4.7	4.8	5.1	5.0
	15-30	5.46	5.5	5.8	5.8
<i>Chemical parameter</i>					
pH	0-15	6.0	6.1	6.3	6.2
	15-30	6.2	6.3	6.3	6.3
EC (dS/m)	0-15	0.06	0.07	0.08	0.08
	15-30	0.09	1.00	0.07	0.07
Organic carbon (%)	0-15	0.51	0.50	0.54	0.53
	15-30	0.53	0.52	0.56	0.54
Total N (%)	0-15	0.03	0.02	0.04	0.04
	15-30	0.05	0.03	0.06	0.06
P (ppm)	0-15	8.2	7.9	7.95	8.2
	15-30	4.0	3.8	4.0	4.0

Application of chemical fertilizers alone will have harmful effect on the dryland crops. However, application of FYM has a definite and clear impact on the soil health in a positive way. Further, FYM application in set rows improved the efficacy of utilization of FYM, as these set rows contained the losses. Through the set row application, slow and short moving nutrients also would be available.

REFERENCES

- Anandswarup. 1999. Long-term fertilizer experiments. (In) *Fifty Years of Natural Resources Management Research in India*, pp. 22. Singh, G.B. and Sharma, B.R. (Eds). Indian Council of Agricultural Research, New Delhi.
- Mathews, A.C. and Stewart, B.A. 1982. Sunflower nutrient uptake, growth and yield as affected by N on manure and plant population. *Agronomy Journal* **74**(5) : 91.
- Patter, P.S., Nadagouda, V.B., Salakinkop, S.R., Kannur, V.S. and Gaddi, A.V. 1999. Effect of organic manures and fertilizer levels on nutrient uptake, soil nutrient status and yield of groundnut (*Arachis hypogaea* L.). *Journal of Oilseeds Research* **16**(1) : 123-127.
- Ravikumar and Krishnamoorthy, 1980. Effect of soil amendments on the chemical properties of vertisols and yield of finger millet. *Madras Agricultural Journal* **67** (6) : 369-374.
- Singh, Shaktawat and Bansal, K.N. 1999. Effect of organic manures and nitrogen on yield, quality and economics of sunflower. *Journal of Oilseeds Research* **16**(1) : 132-134.
- Singh, V.P. 1999. Effect of organic and inorganic sources of nutrients on rainfed wheat (*Triticum aestivum*). *Indian Journal of Agronomy* **44** (2) : 347-352.