Relative Efficiency of Different Green Manure Crops in Relation to Yield of Subsequent Rice Crop*

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ABSTRACT

An investigation was carried out for a period of three years from 1963 to 1965 with a view to study the relative efficiency of different green manure crops in comparision with farmyard manure in relation to yield of subsequent rice crop in different agroclimatic regions of Gujarat at four locations. The results indicated that at Nawagam, *dhaincha* was at par with gliricidia and sunnhemp but it was significantly superior to farmyard manure and *S. Speciosa.* At Dabhol and Chikhli the treatment differences were not significant. At Bardoli, *dhaincha* and *S. Speciosa* were at par and significantly superior to the rest of the treatments.

INTRODUCTION

GREEN manuring has its importance in increasing yield of food crops. The farmers of Gujarat State resort to green manuring in order to improve structure and fertility of their soils. However, scientific development of this practice and growing green manure as a field crop is of recent origin. The practice of green manuring is appreciated gradually in the middle and southern parts of the State where no crop exists during the period between onset of monsoon in the last week of June and transplanting of paddy which is done in the first fortnight of August. Green manuring covered an area of over 18,000 and 77,000 hectares during the years 1961-62 and 1964-65, respectively in Gujarat State. Farmyard manure, no doubt is still the main source of organic matter added to the soil. But the quantity avilable for its application in the State is limited and insufficient even for fraction of the total cultivated area. Among the green manure crops, cultivators of Gujarat are familiar with sunnhemp (*Crotelaria juncea L*), while the use of *dhaincha* (*Sesbania aculeata L.*) and gliricidia (*Gliricidia maculata L.*) is being popularised only recently.

The ameliorating effect of green manuring with black gram on the succeeding crop of sugarcane in Gujarat has been mentioned as early as in 1829 (Chavan and Patil, 1952). In various experiments at Manjari and Baramati farms in Maharashtra State, it has been seen that burying sunn as green manure was better and economical than 30 cartload of farmyard manure (Pandya and

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TABLE—1

Rainfall and other experimental details for different locations.

Location	*Year*	*Rainfall mm*						*Name of variety*	*Spacing cms*	*Transplanting date*	*Harvesting date*
		June	*July*	*August*	*September*	*October*	*Total*				
Nawagam	1963	109	289	198	224	36	856	'Jirasal	30 x 20	25-8-63	22-11-63
	1964	47	251	169	98	—	565	280'		26-8-64	24-11-64
	1965	—	232	113	60	—	405			26-8-65	25-11-65
Dabhoi	1963	5	299	413	167	74	938	'K 42'	22.5 x 22.5	13-8-63	11-12-63
	1964	21	360	349	107	—	837			12-8-64	10-12-64
	1965	—	59	209	17	—	285			21-8-65	2-12-65
Chikhli	1963	38	851	767	182	—	1938	'Z31'	25 x 25	9-7-63	22-11-63
	1964	275	857	778	212	—	2222			13-7-64	20-10-64
	1965	77	890	330	104	—	1401			25-7-65	18-10-65
Bardoli	1963	137	479	527	247	—	1390	'Kada 176-12'	15 x 1	58-8-63	14-11-63
	1964	2'3	1140	592	295	—	2238			11-8-64	2-11-64
	1965	44	726	239	45	—	1052			26/27-7-65	8-11-65

Patil, 1952). In an experiment conducted at the Central Rice Research Institute Cuttack, Nair (1953) noted that 4.545 kg nitrogen as green manure to paddy alone showed good response and compared favourably with higher doses of ammonium sulphate. The results of work done at IARI, New Delhi, by Mirchandani and Khan (1953) indicated superiority of green manuring to farmyard manure and other forms of manures and fertilizers for wheat. The work on green manuring to rice is reviewed by Ghose, Ghatge and Subrahmanyam (1960) and Vachhani and Murty (1964). Due attention was paid to study the importance of green manuring for various crops in Gujarat State some time back. The results of some of these tests are summarised by Choksi (1969). However, with the introduction of new green manure crops, it was considered necessary to study the relative efficiency of different green manure crops under varying agro-climatic conditions of rice growing areas of the State.

METHODS

The present investigation was conducted at the Agricultural Research Stations located at Nawagam, Dabhoi, Bardoli and Chikhli in Gujarat State from 1963 through 1965. Four green manure crops shown in Table 3 were compared with farmyard manure in a completely randomized blocks design with six replications at Dabhoi, Bardoli and Chikhli and four replications at Nawagam. The net plot size was 9.144m × 4.572m at Dabhoi, Bardoli and Chikhli and 20.104m × 3.046m at Nawagam. The experimental plots under green manures were supplied with P_2O_5 at the rate of 22.5 kg/ha at sowing. Paddy was fertilized with 22.5 kg/ha of N and P_2O_5 each at the time of pudling and topdressed at the rate of 22.5 kg/ha N at the time of tillering. Rainfall and other experimental details as shown in Table 1 were found to be highly variable at different locations. Depending on rainfall pattern two to five irrigations were given to rice crop.

RESULTS AND DISCUSSION

The yield of green matter, recorded at Nawagam and Dabhoi, varied from 2391 to 22,390 kg/ha for different crops. The *nutrient content of green manures* determined for Nawagam is presented in Table 2. The grain and straw yield data on rice are presented in Table 3 and 4, respectively.

Grain yield:

At Nawagam, in the year 1963 as well as in the pooled analysis, *dhaincha* was at par with gliricidia and sunnhemp, but it was significantly superior to farmyard manure and *S. speciosa*. Significant treatment differences were not noticed during the year 1964 and 1965. At Dabhoi, the treatment differences were not significant during any year as well as in the pooled analysis. At Chikhli, the treatment differences were significant only during the year 1963. *Dhaincha* significantly increased the paddy yield over farmyard manure but it was at par with other treatments. There was no significant difference between *S. speciosa* and farmyard manure.

At Bardoli in 1963, *dhaincha* was at par with *S. speciosa* and gliricidia. *Dhaincha* produced significantly increa-

TABLE—2

Weight of green matter and total nutrients added through different green manures.

Location	*Year*	*Treatments*			
		Sunnhemp	*Dhaincha*	*S. Speciosa*	*Gliricidia Cluster bean**
		Green matter added kg/ha			
Dabhoi	1963	14944	13557	15574	12481
	1964	Failed	2630	4304	Failed
	1965	2391	2391	2391	2391
Nawagam	1963	10786	9254	4774	5606
	1965	13733	22690	9156	5606
		Total nutrients added kg/ha			
Nawagam	1963	70.11	51.91	25.30	25.75
	1965	153.64	409.73	226.15	68.95
		P_2O_5			
	1965	28.84	77.83	39.10	20.85
		K_2O			
	1965	121.13	515.03	296.65	109.22

**Cluster bean grown at Dabhoi only.*

sed yield over sunnhemp and farmyard manure, the latter two being at par with gliricidia. In the year 1964, *S. speciosa* produced significantly the highest yield, followed by *dhaincha*. Gliricidia and sunnhemp which were at par in this respect. The lowest yield was produced under farmyard manure which did not differ from sunnhemp. In the pooled analysis, *dhaincha* and *S. speciosa* were at par and significantly superior to the rest of the treatments. On the other hand, farmyard manure showed the poorest response. Gliricidia and sunnhemp were equal and intermediate in response.

Straw yield :

At Nawagam, the treatment differences were not significant in 1963 and 1964. In 1965, *dhaincha* was at par with sunnhemp and produced significantly higher yield than that from the rest of the treatments. Sunnhemp was as good as gliricidia. Gliricidia was at par with farmyard manure and *S. speciosa*. In the pooled analysis, *dhaincha* produced the highest yield but it was at par with sunnhemp and gliricidia followed by *S. speciosa*. Farmyard manure produced significantly the lowest yield.

At Dabhoi, the treatments were not significant except in the year

TABLE—3

Effect of different treatments on grain yield of rice at different locations, kg/ha.

Treatments	*Location*															
	Nawagam				*Dabhoi*				*Chikhli*				*Bardoli*			
	1963	*1964*	*1965*	*Mean*	*1963*	*1964*	*1965*	*Mean*	*1963*	*1964*	*1965*	*Mean*	*1963*	*1964*	*1965*	*Mean*
Sunnhemp	3423	3098	3379	3300	2144	3925	3478	3182	3290	3243	2487	3007	2542	1932	2319	2265
Dhaincha	3648	3193	3680	3507	2374	3307	3416	3032	3354	3283	2282	2974	3231	2176	2307	2572
Sesbania speciosa	2934	3057	3285	3092	2401	3268	3646	3105	3023	3352	2398	2925	2964	3005	2290	2552
*Gliricidia/cluster bean**	3515	2939	3149	3201	2398	3347	3268	3004	3310	3418	2621	3118	2729	2004	2260	2331
Farmyard manure at 6.25 t/ha	3164	2951	3310	3142	2300	3327	3376	3001	2865	3191	2371	2819	2361	1626	2211	2066
S.Fm±	150	139	196	123	96	198	158	99	123	190	123	84	179	117	93	32
C.D. at 5%	463	NS	NS	353	NS	NS	NS	NS	364	NS	NS	NS	529	346	NS	91

*Cluster bean at Dabhoi only.
NS Indicates 'F' test to be statistically not significant.

TABLE—4

Effect of different treatments on the straw yield of paddy, kg/ha.

Treatments	*Location*															
	Nawagam				*Dabhoi*				*Chikhli*				*Bardoli*			
	1963	*1964*	*1965*	*Mean*	*1963*	*1964*	*1965*	*Mean*	*1963*	*1964*	*1965*	*Mean*	*1963*	*1964*	*1965*	*Mean*
Sunnhemp	4165	3953	4858	4323	3149	5779	4065	4331	3849	3096	2467	3132	3426	1834	3175	2812
Dhaincha	3941	4279	5271	4479	3288	5100	4024	4139	4001	2905	2455	3132	4362	2231	2829	3142
Sesbania speciosa	3464	3709	4320	3831	3627	4741	4383	4251	3543	3224	2570	3108	4084	2350	3008	3149
Gliricidia/ Cluster bean	4259	3790	4646	4232	3268	4741	3866	3959	3949	3156	2678	5252	4882	1996	2707	3194
Farmyard manure at 6.25 t/ha	3607	3464	4402	3824	3307	4588	3785	3892	3555	2913	2630	5057	4144	1753	2716	2872
S.Em±	256	249	129	124	165	252	271	142	210	166	124	98	323	78	110	219
C.D. at 5%	NS	NS	397	354	NS	743	NS	NS	NS	NS	NS	NS	NS	230	324	NS

1964, wherein sunnhemp produced the highest yield, but it was at par with *dhaincha*. *Dhaincha* was also at par with the rest of the treatments. At Chikhli, none of the treatments showed any significant difference in individual years as well as in the pooled analysis.

At Bardoli, the treatments were not significant in 1963 as well as in the pooled analysis. In 1964, *S. speciosa* produced the highest yield which was at par with *dhaincha*. Sunnhemp was at par with *dhaincha* as well as farmyard manure. In 1965, sunnhemp produced the highest yield, but it did not differ significantly from *S. speciosa*. The latter was also at par with the rest of the treatments.

Thus, the results though not consistent from year to year, it is quite evident that green manuring can substitute the practice of farmyard manure application and reduce the cost. Sunnhemp and *dhaincha* seem to be superior for Nawagam while *dhaincha* and *S. speciosa* seem to be promising for Bardoli. The superiority of these crops may be due to their capacity to withstand high moisture conditions likely to prevail in low-land rice areas as pointed out by Vachhani and Murty (1964).

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