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Effect of insitu moisture conservation and integrated nutrient management on rainfed green gram

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Abstract
Field experiment was conducted at Regional Research Station, TNAU, Aruppukottai to find the effect of *in-situ* water conservation and integrated nutrient management practices on the growth and yield of green gram under rainfed agro ecosystem**.** The experiment was laid out in split plot design with three replications. The main plots consist of three *insitu* water conservation technologies and sub - plots consist of four integrated nutrient management practices with and without coir pith application. The result shows that combined application of 50 per cent N as RDF with 50 per cent N as vermicompost + foliar application of pulse wonder @ 5 kg ha^{-1} during pre-flowering and pod setting for green gram plants in broad bed furrows incorporated with coir pith produced higher grain yield of 813 kg ha^{-1} due to superior growth attributes and yield attributes.

Keywords: *insitu* moisture conservation, INM practice, green gram, yield

Introduction
Pulses are an integral part of many diets across the globe and they have great potential to improve human health, conserve our soils, protect the environment and contribute to global food security. In India pulses occupies an area of 25.2 million hectares with the production of 17.2 million tones and productivity of 665 kg ha^{-1} (Naik *et al*., 2015) [1]. In Tamil Nadu area and production of greengram is 13.63 lakh hectares and 5.96 lakh tones, respectively with the productivity of 438 kg ha^{-1}.

In India 68 per cent of the cultivated area comes under dryland, where the rainfall is erratic, which has to be met from stored soil moisture. Hence, the soils must be able to store maximum water in the profiles to supply moisture for daily ET of the crop. As moisture is one of the most limiting factor in dryland for successful crop production, every effort should be taken for *insitu* conservation. Rain water to be stored in the soil profile to tide over long gaps in the rainfall by adopting suitable land configuration techniques. Again, 50 per cent of the yield increase in dryland crops is attributed to fertilizer application (Singh *et al.*, 2000) [14]. To produce a targeted production about 42 per cent of NPK has to be supplied through fertlilizers and remaining 58 per cent through non chemical nutrient sources (Hedge, 2000). Therefore, there is need to evaluate production performance of green gram under varying insitu management technology and integrated nutrient management. With this view study was take up.

Material and Methods
The experiment was carried out during *rabi* 2017 at upland farm of Regional Research Station, Tamil Nadu Agriculture University, Aruppukottai located at 9º 33' N latitude and 78º 05' E longitude at an altitude of 50 m above mean sea level. The soil of the experimental field was having a pH of 8.5 and EC of 0.2 dSm^{-1}. Taxonomically the soil is classified as clay loam. The experimental field was low in available nitrogen (N) and available phosphorus (P) with high available potassium (K) in the plough layer. The experiment was laid out in split block design and replicated thrice. The main plots consist of three *insitu* water conservation technologies *viz*., broad bed furrow, Ridges and furrows and compartmental bunding with and without coir pith incorporation. The four sub plots were RDF, half substitution of organic with inorganic and remaining where with foliar spray of pulse wonder each. Based on N equal basis required quantities of organic manures were incorporated in the soil one week before sowing. P and K requirements of the crop were applied separately as fertilizer. All the package of practices was carried out as per recommendation of CPG (2012).

All the relevant observations on growth parameters *viz*., plant height, dry matter production

were recorded at periodic interval of the crop growth stages *viz.*, 30, 45 DAS and at harvest stage. The yield and yield attributes of grain yield were recorded as per the procedure. Data of each character collected were statistically analyzed using standard procedure of variance analysis.

Results and Discussion

The results obtained from the present study as well as discussions have been summarized under following heads:

Effect of *insitu* moisture conservation practices

1. Growth attributes

Among the different land configurations, plant height was higher under broad bed furrows (BBF) due to adequate availability of soil moisture especially around the root zone, which reduced soil moisture stress and enhanced normal physiological activities (Table 1). The similar kind of results were reported by Jat *et al*. (2012) [3] and Devaranavadgi and Santhana Bosu (2014). LAI and CGR were significantly higher under BBF system followed by ridges and furrows and compartmental bunding, which might be due to higher soil moisture which favours the nutrient uptake which in turn reflected in higher LAI, number of branches and dry matter production.

The increase in plant height and higher LAI paved the way for more production of photosynthetic dry matter under BBF followed by ridges and furrows. Dwyer and Stewart (1985) [7] and Bharathi *et al*. (1997) reported maximum DMP with increased soil moisture availability and reduction in DMP under moisture stress conditions. Similar results have also been reported by Sarwargaonkar *et al*. (2008) [13] and Gul *et al*. (2015) [8].

2. Yield and Yield attributes

The yield components were found to be higher in BBF followed by other land configuration. This was due to high uptake and assimilation of nutrients which is directly related to availability of soil moisture and yield components in turn are dependent on LAI and DMP as reported by Lalitha (1994) [10].

Increment in grain yield is due to more soil moisture availability at the root zone particularly under subsurface level which favoured better crop growth, more nutrient uptake and higher translocation leading to production of larger LAI which was responsible for harvesting more solar energy. This coupled with higher stomatal conductance and transpiration rate resulted accumulation of more dry matter and yield components and ultimately the grain yield. This is a corroboration with the findings of Muralidaran and Solaimalai (2005) [12] and Kaushik and Gautam (1991) [9]. Similar trend was observed in haulm yield.

Effect of INM practices

1. Growth

The INM practices had a greater impact in increasing plant height, LAI and DMP in green gram (Table 1). The combined application of 50% N through inorganic fertilizers + 50% organic source + pulse wonder spray @ 5 kg ha^{-1} had significant influence on plant height, LAI and DMP. The reason might be due to better availability of moisture due coir pith incorporation which retained more quantum of moisture in soil.

The promising INM practice of 50 % through inorganic + 50 % through organic + foliar spray of increased CGR value over the application of RDN as inorganic fertilizers alone as it could able to nourish the crop with adequate supply of required nutrients as suggested by the Kale *et al*., (1994) [15]. This point was again stressed by Paulpandi (2003) [11]. A favorable physiological conversions of radiant energy into chemical energy could help the crop to increase the accumulation of DMP $plant^{-1}$ at early flower initiation and greater development of reproduction system in green gram. In the present study also the promising INM practice could able to reduce the number of days to fifty percent flowering compared to the applications of RDF as inorganic fertilizers without coir pith incorporation.

2. Yield attributes and yield

The yield attributing characters such as pod length, total number of number of seeds pod^{-1} and test weight were increased due to INM practice of 50 % 0F RDF + 50 % through organic source and application of foliar spray of pulse wonder @ of 5 kg ha^{-1} in incorporated plots (Table 2). The combined effect of organic, inorganic application on the yield attributes was reported by Nanjundappa *et al*., (2001) [6], Mohana keerthi *et al.,* (2015) [2] and Siva *et al.,* (2017) [4]. The favorable maintenance of soil moisture status and nutrient availability by the incorporation of coir pith in addition to organic and inorganic fertilizers application contributed to increased plant height, LAI and subsequently increased DMP. The above applicable increase obtained in growth parameters reflected in increasing yield attributing characters and there by both grain and halum yield.

Addition of foliar spray of pulse wonder at pre flowering and flowering to the above promoising organic and inorganic combination had a greater impact on yield attributing characters particularly pod length and number of seed pod^{-1} over without spray. This is inconformity with Paulpandi (2003) [11] and Mohana keerthi *et al*., (2015) [2].

Table 1: Effect of insitu moisture conservation and INM practices on growth parameters of rainfed green gram

Treatments		Plant height					LAI					60 DAS				
		S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
C_1	M_1	39.9	40.8	41.2	42.7	41.1	1.67	1.72	1.70	1.84	1.73	1300	1603	2100	2306	1827
	M_2	42.2	44.9	45.9	46.2	44.8	1.69	1.78	1.90	1.99	1.84	1705	1900	2508	2614	2180
	M_3	32.9	32.9	34.2	38.2	34.5	1.66	1.68	1.72	1.75	1.70	1500	1701	1901	2209	1452
C_2	M_1	44.8	45.7	46.1	47.6	46.0	3.10	3.17	3.20	3.43	3.22	1302	1700	2104	2803	1977
	M_2	47.1	49.8	50.8	51.1	49.7	3.11	3.21	3.46	3.64	3.35	2000	2302	2805	2903	2502
	M_3	36.7	37.7	39.1	43.1	39.1	3.09	3.11	3.15	3.17	3.13	1722	2203	2104	2300	2082
Mean		40.6	41.9	42.8	44.8		2.37	2.44	2.52	2.63		1588	1901	2253	2522	

Factors	C.D.	SE(d)	C.D.	SE(d)	C.D.	SE(d)
C	1.632	0.544	0.116	0.038	93.265	31.088
M	1.332	0.444	0.095	0.031	76.151	25.383
S	3.311	1.103	0.199	0.066	74.790	24.930

Table 2: Effect of insitu moisture conservation and INM practices on yield parameters of rainfed green gram

Treatments		N uptake					Seeds/pod					Pod length				
		S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
C_1	M_1	37.6	39.2	42.6	43.6	41	7.1	7.0	7.1	7.0	7.1	3.0	3.0	2.5	3.0	2.8
	M_2	42.6	43.6	47.2	48.2	45	7.0	7.0	7.0	7.0	7.0	3,0	3.0	3.0	3.0	3.0
	M_3	35.6	36.5	37.6	39.2	38	7.1	7.0	7.1	7.0	7.1	2.4	3.0	3.0	3.0	2.8
C_2	M_1	41.6	43.1	46.5	47.5	44	9.0	9.1	9.0	9.1	9.0	3.5	3.5	3.5	3.5	3.5
	M_2	46.5	47.5	51.1	52.1	49	9.1	9.0	9.1	9.0	9.1	3.5	3.5	3.9	4.0	3.7
	M_3	39.5	40.4	41.5	43.1	41	9.0	9.1	9.0	9.1	9.0	3.5	3.5	3.5	3.5	3.5
Mean		40.5	41.7	44.4	45.1		8.05	8.0	8.05	8.0		3.1	3.2	3.2	3.3	

Factors	C.D	SE(d)	C.D	SE(d)	C.D	SE(d)
C	0.304	0.364	0.101	0.304	0.102	0.306
M	0.248	0.345	0.082	0.248	0.083	0.249
S	0.641	0.761	0.213	0.641	0.221	0.664

Table 3: Effect of land management and INM practices on grain yield of rainfed green gram

Treatments		Grain yield				
		S_1	S_2	S_3	S_4	Mean
C_1	M_1	464	513	565	614	539
	M_2	564	613	465	713	589
	M_3	363	414	465	513	439
C_2	M_1	564	613	465	613	564
	M_2	665	712	765	813	739
	M_3	463	513	365	615	490
Mean		514	563	515	647	

Factors	SE(d)	C.D
C	9.983	29.951
M	8.152	24.458
S	7.370	22.110
M X S	10.423	31.269
C X M X S	18.053	54.159

Conclusion

In rainfed areas, if field is incorporated with soil conditioners like coir pith, land is configured into broad beds and furrows (BBF) it would help to conserve the soil moisture. Again integration of 50 per cent RDN by fertilizers with 50 per cent RDN by vermicompost with pulse wonder @ 5 kg ha^{-1} found to be best practice for green gram grown under rainfed in vertisol.

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