Effect of Integration of organic, inorganic and micronutrient fertilization on Rice-Pulse/Gingelly cropping system

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Abstract

Field experiments were conducted during Navarai and Thaladi season at Annamalai University Experimental farm, to study effect of organic, inorganic and micronutrient fertilization in Rice-Pulse/Gingelly cropping system. The experiments were laid in randomized block design with three replications and among the 9 treatments application of RDF along with FYM @ 12.5t/ha + $ZnSo_4$ @ 0.5% foliar application had favorable influence on growth components of rice in both season followed by seed treatment of Azospirillum @ 600g/ha+ NAA 300 ppm foliar spray registered an increase in yield components of sesame which was stastically on par with the yield components of rice fallow blackgram, seed treated with phosphobacteria @ 600g/ha+2% DAP spray.

Key words: *Rice,pulse,sesame,foliar application.*

Introduction

Rice being a predominant food crop that is being extensively cultivated in India. It is cultivated overa an area of 36.95m.ha with a production of about 80.41 m.t. (Agricultural Statistics, 2010), in Tamil Nadu it is cultivated over an area of 1.93m.ha with a production of 6.61m.t. Growing of blackgram in rice fallow as a catch crop is also a traditional cropping system of the Cauvery deltaic region which is same in case of growing Gingelly. The Cauvery deltaic zone contributes a major share for rice production of Tamil Nadu and there is a vast scope for gingelly/blackgram cultivation under rice fallow in the Cauvery deltaic zone if adequate agronomic strategies are worked out. Farm yard manure is the most commonly used organic manure but it is limited in supply of nutrient, it has been found most suitable in rice soil for its rapid decomposition, mobilization of nutrient and improvement in soil physical conditions.(Aulakh *et al.*,).

Among the biofertilizer, phosphobacteria for pulses and Azospirillum for gingelly which can be more appropriately called microbial inoculants which plays important role in improving the chemical and physical nature of soil, continuous use of this biofertilizers results in gradual build-up of microbial population in the soil which on many occasions lead to stabilization of their effect even in the absence of fresh inoculation (Goyal, 1991). The long term addition of organic material to soil results in increased the crop productivity, quality of produce and soil biological activity (Collins *et al.,* 1992). Use of higher dose of

high analysis fertilizers containing high amounts of N,P and K only and insufficient use of organics has created deficiencies of secondary and micronutrient particularly Zn and Fe (Takkar, 1996).

The soils are showing signs of fatigue as judged by decline in the yields of rice as a lower response to applied chemical fertilizer (Yadav *et al.,* 1998). Hence foliar fertilization is the simple and effective method of providing nutrient to crop (Alexander and Schroeder, 1987). It plays a vital role in pulse production by stimulating root development, nodulation, energy transformation, various metabolic process, translocation activity in plants and pod setting and thereby increase the yield (Paikara *et al.,* 1988). It also supply the nutrient to plant directly and they are needed for higher production without spending energy for their transport and without any loss in transit (Srivastava, 1995). Considering the above said facts, there is a vast scope for increasing nutrient supply through use of integrated nutrient management practices and adoption of proper cropping system, which together can contribute significantly to the required nutrient pool. Therefore the present study was designed to assess the possible effects of integrated nutrient management in rice-pulse/gingelly cropping system.

MATERIALS AND METHODS

The experiment was carried out at Annamalai University Experimental Farm, Annamalai Nagar during Navarai and Thaladi season. The experiments were laid out in Randomized Block Design with nine treatment combination and three replications with rice variety ADT-43. The treatments comprised of (T_1) control, (T_2) recommended dose of FYM @12.5 t/ha, (T_3) Green manuring @6.25t/ha, (T_4) $ZnSo_4$ as soil application, (T_5) $ZnSo_4$ as foliar application, (T_6) FYM+ $ZnSo_4$ @ 25kg/ha soil applied, (T_7) FYM+ $ZnSo_4$ @ 25kg/ha as foliar application, (T_8) GM+ $ZnSo_4$ as soil application, (T_9) GM+ $ZnSo_4$ as foliar application, following the cultivation of gingelly was carried out during Navarai using variety TMV-3 its treatment comprised of (T_1) control and all the other treatments were comprised of Azospirillum seed treatment @600 g/ha+NAA 30 ppm as foliar application were tried to find the residual effect of organic and inorganic nutrient applied on rice crop. As the same as first trial the field experiment was carried out during Thaladi in RBD with nine treatments and three replication by using fallow crop as blackgram variety ADT-43, the treatment comprised of (T_1) control and in all other treatments phosphobacteria @600 g/ha + 2% DAP as foliar application were applied to evaluate the residual effect of organic and inorganic nutrients applied on the rice crop. The necessary observation were taken to carry out statistical and economic analysis.

Result and Discussion

Among the various treatment practices compared it was observed that highest plant height (86.10cm and 82.21cm), LAI(6.32 cm and 6.32 cm), DMP(10621.1 kg ha^{-1} and 10219.0 kg ha^{-1}) were higher with the application of 100 % recommended dose of fertilizer along with FYM @ 12.5 t/ha and $ZnSO_4$ @ 0.5% foliar application (T_7). The enhanced growth might be due more availability of N during different growth stages from organic and inorganic sources which helped in promotion of growth characters. These results

are in consonance with the findings of Swamy *et al.*, (1990), Bahmanyar and Piradshti (2008). The least growth components were recorded under 100% RDF @ 12.5t/ha (T_1).

In the case of rice fallow gingelly the treatment with Azospirillum seed treatment @ 600g/ha + NAA 30 ppm foliar application (T_7) recorded the maximum plant height (85.5cm), LAI (1.46) and DMP (6078.98) this is due to application of optimum quantity nutrients helped in synthesis of chlorophyll and amino acids which contributed to building units of protein and thus growth and crop biomass increased. The present findings was in conformity with the earlier reports of Kalaiselvam *et al.*, (2002) and Bharathi (2005). The least growth was observed in the treatment (T_1) control. Regarding the another fallow crop blackgram there was a significant increase in plant height (28.79 cm), LAI (4.23), DMP (3578.31 kg/ha) in (T_7) which comprises of phosphobacteria seed treatment @ 600 g/ha + DAP 2% foliar application. The enhancement in growth components was due to foliar application of 2% DAP along with seed treatment of phosphobacteria. The increase in growth was due to increase in protein synthesis and cell growth which have also been reported by Geetha and Velayatham (2009). Foliar application of nutrients have increased the cytokinin content which delayed leaf senescence resulting in effective photoassimilatory surface. The results are in agreement with Rajendran (1991). The least value was recorded in treatment (T_1) control. Hence rice fallow blackgram can be suggested as agronomically efficient cropping system.

Table1: Effect of INM on growth attributes in rice

Treatment	Plant height(cm)		LAI		DMP (kg ha^{-1})		Grain Yield (kg ha^{-1})	
	Navarai	Thaladi	Navarai	Thaladi	Navarai	Thaladi	Navarai	Thaladi
T_1	65.41	62.1	4.87	3.70	8011.21	7637.17	3228.00	3017.00
T_2	79.35	75.71	5.6	5.24	9751.01	9355.42	4617.70	4415.36
T_3	69.97	66.54	4.89	4.89	8591.61	8207.44	3692.51	3482.50
T_4	72.30	68.83	5.02	5.02	8863.31	8494.49	3923.71	3714.94
T_5	74.17	71.13	5.21	5.21	9158.51	8781.49	4155.51	3948.35
T_6	81.70	77.98	5.93	5.93	10038.32	9642.37	4850.40	4650.66
T_7	86.10	82.21	6.32	6.32	10621.12	10219.11	5313.00	5117.00
T_8	83.10	79.95	6.07	6.07	10327.32	9729.01	5079.70	4881.85
T_9	79.95	73.4	5.41	5.41	9452.61	9068.52	4388.62	4184.85
S.ED	1.10	1.07	0.09	0.13	140.79	127.35	112.34	133.15
C.D(0.05%)	2.29	2.33	1.16	0.26	289.99	286.88	231.66	233. 33

Table 2: Effect of INM on growth attributes of rice fallow Gingelly and Blackgram

Treatment	Rice fallow Gingelly				Treatment	Rice fallow Blackgram			
	Plant height (cm)	LAI	DMP (kg ha^{-1})	GrainYied (kg ha^{-1})		Plant height (cm)	LAI	DMP (kg ha^{-1})	GrainYield (kg ha^{-1})
T_1	49.80	0.81	5110.17	280	T_1	19.29	1.87	2027.28	448
T_2	72.75	1.19	5753.24	430	T_2	23.32	3.46	3061.12	604
T_3	56.47	0.86	5323.15	325	T_3	19.08	2.31	2370.17	476
T_4	60.37	0.93	5645.45	351	T_4	20.13	2.60	2716.27	510
T_5	64.67	0.99	5429.45	378	T_5	21.20	2.87	2543.17	542
T_6	77.03	1.29	5861.54	467	T_6	24.39	3.75	3233.50	636
T_7	85.20	1.46	6078.98	510	T_7	28.79	4.23	3578.31	698
T_8	80.90	1.33	5968.34	480	T_8	25.49	3.94	3404.65	657
T_9	68.77	1.08	5537.55	405	T_9	22.26	3.15	2888.72	575
S.ED	1.88	0.03	52.20	12.75	S.ED	0.51	0.13	83.55	13.84
C.D (0.05%)	3.93	0.07	107.64	25.5	C.D (0.05%)	1.05	0.26	172.33	27.7

Conclusion:

Considering the above results, it could be concluded that application oof recommended dose of fertilizer + FYM @ 12.5t/ha + $ZnSO_4$ @ 0.5 per cent (foliar application) in rice and phosphobacteria seed treatment @ 600 g/ha + DAP 2% foliar application in rice fallow blackgram could be suggested as an ecofriendly and agronomically efficient cropping system for Cauvery deltaic region with attractive economic return and better diversification of farm products.

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