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## SOIL TEST CROP RESPONSE STUDIES FOR RAINFED SORGHUM

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### ABSTRACT

Field experiments were conducted in Vertic Ustochrept to find out the feasibility of adoption of soil test based fertiliser recommendations for rainfed sorghum. Fifty per cent of NPK fertilisers recommended for irrigated sorghum, as per targeted yield and Mitscherlich-Bray concept were applied to rainfed sorghum and these two methods were compared with blanket recommendation. Results showed that targeted yield approach recorded higher yield, response yardstick and benefit cost ratio than Mitscherlich-Bray and blanket recommendations. Hence, for better fertiliser use efficiency, yield and profit, 50 per cent of NPK prescribed for any desired yield targets of irrigated sorghum could be recommended for rainfed crop, in the mixed black soils of Western Zone of Tamil Nadu.

**KEY WORDS:** Soil test based fertiliser doses, response yardstick, Benefit Cost Ratio

Coarse grain and pulse crops are grown mostly as rainfed crops. Among the several factors that cause low yields of rainfed crops, inadequate application of fertilisers to dryland crops is a major one (Tandon, 1993). The blanket recommendation of rainfed millets is 40 and 20 kg ha<sup>-1</sup> of N and P<sub>2</sub>O<sub>5</sub>, respectively. However, while augmenting the nutrient supply of any crop through fertilisers due allowance must be given to the nutrients that are supplied through native soil source. A soil test usually gives the relative amount of the available nutrient present in the soil. For the most economic rates of fertilisers for the crops to be grown in any type of soil, the soil tests could be interpreted in terms of the expected crop response to added fertilisers. The modified Mitscherlich-Bray (Bray, 1954) and Targeted Yield (Ramamoorthy *et al.*, 1969) approaches are the basis for arriving at such soil test based fertiliser doses. An attempt was made in the present investigation, to find out the

feasibility of adoption of such approaches to recommend fertiliser doses for rainfed sorghum.

### MATERIALS AND METHODS

Field experiments were conducted during *Kharif* 1992 and 1993 in mixed black soil (Vertic Ustochrept) at Tamil Nadu Agricultural University Farm in Coimbatore. The initial soil samples were analysed and it was found to contain 280 kg of alkaline KMnO<sub>4</sub>-N (Subbiah and Asija, 1956), 10 kg of Olsen-P (Olsen *et al.*, 1954) and 400 kg of NH<sub>4</sub> OAc-K (Standford and English, 1949) per hectare. The pH was 8.2 and E.C. was 0.2 dSm<sup>-1</sup>. The test crop was sorghum var. CO 26. There were five treatments replicated four times in randomised block design. The treatments were (i) control, (ii) blanket recommendation, (iii) 50 per cent of NPK recommended for irrigated sorghum by soil testing laboratory based on modified Mitscherlich-Bray concept, (iv) fifty per cent of NPK recommended

for 30 q/ha yield of irrigated sorghum based on Targeted yield concept and (v) 50 per cent of NPK recommended for 40 q/ha yield of irrigated sorghum based on Targeted Yield concept. Since the optimum amount of fertiliser under rainfed condition would be 50 per cent of that recorded under irrigated conditions, the NPK doses were fixed as 50 per cent of the recommended for irrigated crop. The actual quantities of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O applied are furnished in Table 1.

The fertilisers were applied basally and the crop was grown to maturity. At maturity the crop was harvested. The grain and straw yields were recorded. The yield data were statistically analysed. The response yardstick (kg of grain/kg of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O applied) and the benefit cost ratio (additional return/additional input cost) were worked out for the various treatments. The results are furnished in Table 1.

## RESULTS AND DISCUSSION

Treatments received fertiliser doses as per modified Mitscherlich-Bray and Targeted yield concept recorded significantly higher grain yield of rainfed sorghum than blanket method of fertiliser

application, thereby indicating the superiority of soil test based fertiliser recommendations over blanket method. Between the two approaches to recommend soil test based fertiliser doses, the Targeted yield concept was found to be better than Mitscherlich-Bray concept both in terms of response yardstick and benefit cost ratio. In the Mitscherlich-Bray method, 7.6 kg of grain was produced per one kg of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O whereas it was 10.0 to 21.8 kg in the Targeted yield approach.

Ramamoorthy *et al.*, (1969) showed that fertiliser recommendations made on the principle of Targeted yields for bajra grown under rainfed conditions resulted in efficient fertiliser use. Similar findings were reported by Reddy *et al.*, (1989) on kenaf (*Hibiscus sabdarifa*). In the Targeted yield approach, soil as well as plant testing were done for making fertiliser recommendations. The fertiliser doses were adjusted to the native available nutrients as well as to the nutrient requirement of crop and thus a balanced supply of nutrient was possible. This could be attributed to the higher response yardstick which indicated the higher use efficiency of added fertilisers. Better use efficiency

Table 1. Response of rainfed sorghum for NPK fertiliser application

S.No.	Treatments	Quantity of nutrients added (kg ha <sup>-1</sup> )			Yield of grain* (kg ha <sup>-1</sup> )	Response ratio (kg kg <sup>-1</sup> )	BCR
		N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O			
1.	Control	0	0	0	2005	-	-
2.	Blanket	40	20	0	2530	8.8	4.7
3.	STL method	33	67	0	2765	7.6	3.0
4.	STCR (30 q ha <sup>-1</sup> )	0	14	8	2485	21.8	9.0
5.	STCR (40 q ha <sup>-1</sup> )	27	24	26	2775	10.0	5.5

\* Mean grain yield

Initial soil test values (kg ha<sup>-1</sup>)

Alkaline KMnO<sub>4</sub>-N = 280

Olsen-P = 10.0

NH<sub>4</sub>OAc-K = 400

would pave the way for the higher yield and benefit cost ratio. Thus, the study has brought out that in the mixed black soils of Western zone of Tamil Nadu, recommending 50 per cent of NPK doses prescribed as per targetted yield concept under irrigated conditions for rainfed sorghum is the best practice for efficient fertiliser use, higher yield and net profit.

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## PHYSIOLOGICAL APPROACHES FOR IMPROVING YIELD OF RICE UNDER LOW IRRADIANCE

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#### ABSTRACT

A field experiment was conducted to investigate the efficacy of a few growth regulators / botanicals / chemicals on alleviating low irradiance stress in rice (*Oryza sativa* L.) High LAI, increased accumulation of chlorophylls, higher soluble protein content and higher NRase activity were evident in the treated plants resulting in increased biomass accumulation. Increased number of spikelets and reduction in spikelet sterility contributed to higher yield. Brassinosteroid treatment recorded highest yield (4.76 t ha<sup>-1</sup>) followed by salicylic acid (4.62 t ha<sup>-1</sup>), coconut water (4.40 t ha<sup>-1</sup>) and diammonium phosphate (4.32 t ha<sup>-1</sup>) as against the lowest of 3.46 t ha<sup>-1</sup> in control.

**KEY WORDS :** Rice, Low irradiance, Growth regulators, Botanicals, Brassinosteroid, Stress alleviation, Photosynthesis, Yield.

South-East Asian countries including India grow more than 80 per cent of rice crop during monsoon season. In cauvery Delta Zone, the 'Rice Bowl' of Tamil Nadu, about 70-80 per cent of rice is grown during monsoon season (Samba/Thaladi). During this period, cloudy weather prevails and the irradiance is 40 to 60 per cent less than dry season which reduce rice yield upto 50% (Venkateswarlu, 1977) by reducing tillering, panicle weight and dry matter production (Thangaraj and Sivasubramanian, 1990). Growth regulators were

reported to vary in amount under low irradiance with drastic reduction in auxins cytokinis (Murthy and Murthy, 1982). Salicylic acid (Jain and Srivastava, 1981) and brassinosteroids (Sairam, 1994) were known to impart tolerance in plants to environmental stress through modification of metabolic processes. Other growth hormones/ botanicals were also reported to improve grain filling in rice under low irradiance (Singh *et al.*, 1984 ; Thangaraj and Sivasubramanian, 1992). In the present investigation an attempt has been

