

RESEARCH ARTICLE :

STCR approach for optimizing yield and economics in sunflower

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SUMMARY : STCR approach for target yield is unique in indicating both soil test based fertilizer dose and the level of yield that can be achieved with good agronomic practices. A field experiment was conducted to validate the STCR equation developed for sunflower crop of cuddapah soils of Andhra Pradesh. It was observed that the highest yield of 22.23 q/ha was obtained in treatment T₃ (Targeted yield of 22 q ha⁻¹ with chemical fertilizers+ VC 5 t ha⁻¹) over farmers practice (13.71 q/ha). Even the B:C ratio was more in T₃ compared to farmers practice.

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Approach, Economic, Sunflower

BACKGROUND AND OBJECTIVES

Sunflower (*Helianthus annuus* L.) is an important oilseed crop fourth next to soybean, groundnut and rape seed. Now a days, the crop has been well accepted by the farming community because of its desirable attributes such as its short duration, photoperiod insensitivity, adaptability to wide range of soil and climatic conditions, drought tolerance, lower seed rate, higher seed multiplication ratio and high quality of edible oil. In India, sunflower is grown over an area of 5.89 lakh hectares with a production and productivity of 4.34 lakh tonnes and 736 kg per hectare, respectively during the year of 2014-15 (Ministry of Agriculture, Govt. of India).

Among the various factors affecting the

growth and yield of sunflower, nutrient management practices play a vital role. Presently, the chemical fertilizers are used as a major source of nutrients. But escalating cost, coupled with increasing demand for chemical fertilizers and depleting soil health necessitates the safe and efficient method of nutrient application. Some practices gaining much popularity to enhance and maintain soil fertility and reduce the continuous and over dose use of inorganic fertilizer application which may adversely affect the physico-chemical properties of soil and thereby affect the crop performance. The effective fertilizer recommendation should consider crop needs and nutrients already available in the soil. Among various methods of fertilizer

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recommendation such as general recommended dose (GRD), soil test based recommendation, critical value approach, etc., the soil test crop response (STCR) approach for target yield is unique in indicating both soil test based fertilizer dose and the level of yield that can be achieved with good agronomic practices. The objective of this study was to investigate the effect of fertilizer prescriptions by different approaches on quality and yield production of sunflower.

Sunflower being a nutrient exhaustive crop, it requires huge amount of nutrients. Present recommendation to sunflower crop is 60kg N, 90 kg P₂O₅ and 30 kg K₂O ha⁻¹. However, sandy loam soil with poor soil fertility and also depletion of soil nutrients due to low organic matter in soil is resulting in poor sunflower yields. Adequate fertilizer application is considered as most important factor in enhancing yield of sunflower crop through different fertilizer applications such as general recommended dose of fertilizer, soil test based recommendation, critical value approach etc. The soil test crop response (STCR) approach for targeted yield is unique in indicating both soil test based fertilizer dose and the level of yield that can be achieved with good management practices. In order to sustain the yield and reduce the cost of fertilizers and in turn cost of cultivation, the STCR approach is very important (Saxena *et al.*, 2008 and Chatterjee *et al.*, 2010). Targeted yield approach stricken a balance between fertilizing the crop and fertilizing the soil (Sonar *et al.*, 1982). The yield targeted STCR equation for sunflower crop was developed for cuddapah soils in Southern zone of Andhra Pradesh. Sunflower is one of the major crop in Cuddapah district and farmers are applying inadequate and imbalanced fertilizers.

Keeping this in view, the present experiment was taken up to evaluate and validate the STCR equation developed for sunflower crop.

RESOURCES AND METHODS

STCR approach was adopted to conduct the field experiment at Agricultural Research Station, Utukur, Cuddapah, Andhra Pradesh, India. Composite soil sample was drawn from the experimental site at 0-15 cm depth prior to laying out of experiment. The soil samples were analyzed by adopting standard procedures (Nitrogen - Subbaiah and Asija method (1956), Phosphorus - Olsen *et al.* (1954), Potassium - Jackson (1973).

The soil was slightly alkaline in reaction (7.6), non saline (0.20 dS m⁻¹), low in organic carbon (0.23) %, low in available N (138 kg ha⁻¹), high in phosphorus (62 kg ha⁻¹) and medium in available K (135kg ha⁻¹). The experiment was laid out in randomized block design with the following six treatments and 4 replications.

Treatments : 6

T₁: Sunflower Targeted yield of 22 q ha⁻¹ with chemical fertilizers

T₂: Sunflower Targeted yield of 20 q ha⁻¹ with chemical fertilizers

T₃: Sunflower Targeted yield of 22 q ha⁻¹ with chemical fertilizers+ VC 5 t ha⁻¹

T₄: Sunflower Targeted yield of 20 q ha⁻¹ with chemical fertilizers + VC 5 t ha⁻¹

T₅: General Recommendation of fertilizers (RDF)

T₆: Farmers Practice

The fertilizer adjustment equation was developed for sunflower in Cuddapah district soils by STCR scheme, AICRP on STCR, Agricultural Research Institute, Rajendranagar, Hyderabad was used for validation of that equation with other fertilizer practices.

Fertilizer Adjustment Equation adopted

$$F N = 11.81 T - 1.13 SN - 1.54 VC N$$

$$F P_2O_5 = 4.04 T - 1.80 SP - 1.20 VC P$$

$$F K_2O = 2.23 T - 0.17 SK - 0.19 VC K$$

Using the above fertilizer adjustment equations the quantity of fertilizer nutrients required for achieving 20 and 22q ha⁻¹ of sunflower were worked out and quantity of fertilizers applied to each treatment as per STCR equation is presented in Table A.

OBSERVATIONS AND ANALYSIS

Sunflower has recorded highest seed yield in T₃ treatment over farmers practice (T₆) and recommended dose of fertilizer (T₅). The per cent increase in T₃ over T₆ was 38%. The increase in yield due to application of fertilizers based on different approaches was attributed to the increase in growth and yield attributes as a consequent of improved nutrient supply and efficiency of applied fertilizers in soil (Apoorva *et al.*, 2010, Debarati and Poonam, 2013, Tegegne work *et al.*, 2015). The deviation in seed yield obtained from that of desired targeted yield of 22 qha⁻¹ was -1.27%, -6.14%, +1, -4.27% in T₁, T₂, T₃ and T₄, respectively. This indicated that the fertilizers applied along with VC for targeted yield of 22 q ha⁻¹ recorded higher seed yields without

Treatment	Nutrient (kg/ha) N-P ₂ O ₅ -K ₂ O
T ₁ : Sunflower Targeted yield of 22 q ha ⁻¹ with chemical fertilizers	101-50-13
T ₂ : Sunflower Targeted yield of 20 q ha ⁻¹ with chemical fertilizers	79-40-08
T ₃ : Sunflower Targeted yield of 22 q ha ⁻¹ with chemical fertilizers+ VC 5 t ha ⁻¹	101-49-12
T ₄ : Sunflower Targeted yield of 20 q ha ⁻¹ with chemical fertilizers + VC 5 t ha ⁻¹	72- 37 -08
T ₅ : General Recommendation of fertilizers (RDF)	60-90-30
T ₆ : Farmers Practice	160-64-30

Treatments	Seed yield (qha ⁻¹)
T ₁ : Sunflower Targeted yield of 22 q ha ⁻¹ with chemical fertilizers	21.72
T ₂ : Sunflower Targeted yield of 20 q ha ⁻¹ with chemical fertilizers	20.65
T ₃ : Sunflower Targeted yield of 22 q ha ⁻¹ with chemical fertilizers+ VC 5 t ha ⁻¹	22.23
T ₄ : Sunflower Targeted yield of 20 q ha ⁻¹ with chemical fertilizers + VC 5 t ha ⁻¹	21.06
T ₅ : General Recommendation of fertilizers (RDF)	15.81
T ₆ : Farmers Practice	13.71

Treatment	B:C ratio
T ₁ : Sunflower Targeted yield of 22 q ha ⁻¹ with chemical fertilizers	2.90
T ₂ : Sunflower Targeted yield of 20 q ha ⁻¹ with chemical fertilizers	2.86
T ₃ : Sunflower Targeted yield of 22 q ha ⁻¹ with chemical fertilizers+ VC 5 t ha ⁻¹	2.10
T ₄ : Sunflower Targeted yield of 20 q ha ⁻¹ with chemical fertilizers + VC 5 t ha ⁻¹	2.05
T ₅ : General Recommendation of fertilizers (RDF)	1.42
T ₆ : Farmers Practice	1.26

any negative deviation in all seasons than targeted yield of 22q ha⁻¹ with chemical fertilizers alone. Even the benefit cost ratio was more in T₃ compared to farmers practice.

Conclusion :

The results revealed that application of fertilizers based on STCR equation for target yield of 20 and 22 q ha⁻¹ recorded highest seed yield in T₁, T₂, T₃ and T₄, respectively over T₅ and T₆. However, the STCR equation for targeted yield of 22 q ha⁻¹ in sunflower could be achieved without any negative deviation in Cuddapah district soils.

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