EuroSciCon
5th Annual Congress on
Plant & Soil Science
Plant Science 2019
February 28-March 01, 2019 | London, UK

Optimization of Agronomic Combinations to Mitigate Drought Impact on Safflower (*Carthamus Tinctorius* L.) Productivity under Receding Soil Moisture Conditions

Sudhakar Chourat, PhD, PJTSAU, India
Sudha Rani C., PhD, PJTSAU, India
Rajeshwar Reddy T., PJTSAU, India
Pushpavalli SNCVL., PhD, PJTSAU, India
Padmavathi P, IIOR, India

Abstract (300-word limit)

A field experiment was conducted during the year 2017-18 to study the to study the effect of preceding Greengram/Soybean on Safflower in terms of Yield, economics and drought mitigation and also to identify the suitable Agronomic combination of Fertilizer doses and Plant spacings for Safflower in relation to drought mitigation on Vertisol under rainfed conditions. Accordingly, the experiment was planned with three Kharif (rainy season) crop options viz., fallow, Greengram and Soybean; and in Rabi (post-rainy season) three plant spacing viz., 30 x 20, 45 x 20 and 60 x 20 cm; and four fertility levels viz., 50% NPK (20-12.5-0), 100% NPK (40-25-0), SSNM (16-66-0) and 50% SSNM (8-33-0 kg N, P and K/ha). During kharif (rainy season), three crop options laid as main plot treatments and the treatment combinations of three plant spacings and four fertility levels as sub plot and sub-sub plots, respectively were tested against Safflower during Rabi in a double split plot design and replicated twice. Seed yield of safflower was significantly higher when fallow was maintained (1231 kg/ha) as compared to that of greengram (1061 kg/ha) and soybean (992 kg/ha) grown during preceding season. Crop geometry of 45x20 cm was found to be optimum for safflower as it resulted in significantly higher seed yield of 1203 kg/ha which was 19.4 and 28.3% higher than that of 30x20 cm and 60x20 cm, respectively. Supply of nutrients through Site specific nutrient management (SSNM) in safflower not only gave highest seed yield (1314 kg/ha) but it was also significantly higher by 11% over supply of 100% NPK (1002 kg/ha) and 50% SSNM (1157 kg/ha) and 50 % NPK (905 kg/ha). Irrespective of plant spacings, supply of nutrients through 100% SSNM resulted in significantly higher seed yield as compared to other fertilizer levels. Available soil moisture (%) was highest in rainy season fallow at different crop phenophases of Safflower viz., elongation (24.05%) and 50% flowering (13.70%) which accounts to 6.5% and 9.8% higher over Greengram-Safflower and Soybean-Safflower systems, respectively.

Methodology and Theoretical Orientation:

There is growing evidence that the climate change do has implications for drought vulnerable India with studies projecting future possible reductions in monsoon related rainfall in the country. The existing drought risk mitigation and response mechanisms need to be looked into and gaps are to be identified by drawing lessons from previous disasters and response mechanisms. Safflower being a crop grown during Rabi under residual soil moisture, it frequently encounter terminal drought stress. Thus, evolving drought mitigation options has become imperative in the current climatic conditions. Keeping these exigencies in view, the present investigation was under taken at Agricultural Research Station, PJTS Agricultural University, Tandur, Telangana State, India to study the effect of preceding Greengram/Soybean on Safflower in terms of Yield, economics and drought mitigation and also to identify the suitable Agronomic combination of Fertilizer doses and Plant spacings for Safflower in relation to drought mitigation on Vertisol soil rainfed conditions. Considerable research work has been done to assess the nitrogen requirement of safflower (Abel, 1976). However, the results of recent experiments on fertilizer use in cropping systems revealed that fertilizer recommendations should be based on whole cropping systems rather than on individual crops. Yield-attributing characteristics of safflower improved when grown after green gram as compared to those after fallow and rice. Seed yield of safflower was maximal in the green gram-safflower sequence, but yield differences became significant only in the second year. This indicates that green gram took two years to establish a significant legume effect. Drought is considered as one of the main environmental factors that cause osmotic stress and inversely influence plant performance as well as global crop production (Saruhan Güler et al. 2012). Drought stress is the most important factor limiting crops production in agricultural systems in arid and semi-arid regions (Mollasadeghi et al., 2011).Water deficit stress severely limits crop growth especially in arid and semi-arid regions of the world as it affects all stages of plant growth and development (Shamim et al., 2009). The beneficial effect of green gram on the succeeding safflower may be due to decomposition of sloughed off and dead nodules in the soil (Meelu and Rana, 1981; Walker et al., 1954). Row distances (plant density) and Nitrogen fertilizer are two important factors in crop management for optimizing productivity. There is a variation between the response of crops to different row distances and nitrogen rates. The row distances and nitrogen rates significantly affected some important growth, yield and yield components of safflower. According to the results, in order to cultivate safflower as an oil crop in conditions similar to the region of this experiment, application of 30 cm row distance and 150 kg N ha^{-1} for the highest return unit area were recommended (Tamer Eryiğit et. al., 2015).

Techniques adopted

Treatments :

Main Plot (3): Kharif crops:
M1. Fallow,
M2. Greengram,
M3. Soybean

Sub-plots: Plant Spacings (3):
S1. 30 x 20,
S2. 45 x 20,
S3. 60 x 20,

Sub-Sub Plots: Fertilizers(4):
S-S1. 50% NPK (20-12.5-0),
S-S2. 100% NPK (40-25-0),
S-S3. SSNM (16-66-0),
S-S4. 50% SSNM (8-33-0)

DESIGN : Split-Split Design Replications: 2 RDF: 40-25-0 Kg NPK/ha. SSNM: 16-66-0 Kg NPK/ha.

Findings:

Results revealed that, Seed yield of safflower was significantly influenced by preceding *kharif* crops , geometry and fertility levels. Seed yield of safflower was significantly higher when fallow was maintained (1231 kg/ha) as compared to that of greengram (1061 kg/ha) and soybean (992 kg/ha) grown during preceding season. Crop geometry of 45x20 cm was found to be optimum for safflower as it resulted in significantly higher seed yield of 1203 kg/ha which was 19.4 and 28.3% higher than that of 30x20 cm and 60x20 cm, respectively. Supply of nutrients through Site specific nutrient management (SSNM) in safflower not only gave highest seed yield (1314 kg/ha) but it was also significantly higher by 11% over supply of 100% NPK (1002 kg/ha) and 50% SSNM (1157 kg/ha) and 50 % NPK (905 kg/ha). The data on *kharif* crops at same level of spacings indicated that seed yield of safflower was significantly higher when *rabi* crop is preceded by fallow rather than green gram or soybean. Likewise, spacing at same preceding crop revealed significant superiority of 45x20 cm in terms of seed yield of safflower. Seed yield of safflower did not significantly due to *kharif* crops at same level of fertilizer. The data on fertilizer levels at same preceding *kharif* crops revealed that 100% SSNM was found significantly superior to rest of the fertilizer levels. At a given fertilizer level, safflower crops grown at 45x20 cm spacing produced significantly higher seed yield than at narrow (30x20 cm) and wider row spacings (60x20 cm). Irrespective of plant spacings, supply of nutrients through 100% SSNM resulted in significantly higher seed yield as compared to other fertilizer levels. However, F3 was at par with F2 at wider spacing (60x20 cm). With respect to the System productivity in terms of Safflower equivalent yield, Safflower - greengram recorded significantly highest SY (3391 Kg/ha.) followed by Safflower - Soybean system (3302 Kg/ha.). Among the plant spacings, 45X20 cm registered the maximum system yield in terms of Safflower equivalents (2750 Kg/ha.), while, 30X20 cm and 60X20 cm recorded on par values. Fertilizer application following SSNM registered significantly highest system yield in terms of Safflower equivalents (2861 Kg/ha.) followed by 50% SSNM (2703 Kg/ha.) while, 100% and 50% RDF recorded on par SY. Available soil moisture (%) was highest in rainy season fallow at different crop phenophases of Safflower viz., elongation (24.05%) and 50% flowering (13.70%) which accounts to 6.5% and 9.8% higher over Greengram-Safflower and Soybean-Safflower systems, respectively.

Conclusion and Significance:

Seed yield of safflower was significantly influenced by preceding *kharif* crops, crop geometry and fertility levels. Seed yield of safflower was significantly higher when fallow was maintained (1231 kg/ha) during *Kharif* season consequent to better moisture retention. Available soil moisture (%) was highest in rainy season fallow at different crop phenophases of Safflower viz., elongation (24.05%) and 50% flowering (13.70%) which accounts to 6.5% and 9.8% higher over Greengram-Safflower and Soybean-Safflower systems, respectively. Crop geometry of 45x20 cm was found to be optimum for safflower as it resulted in significantly higher seed yield of 1203 kg/ha which was 19.4 and 28.3% higher than that of 30x20 cm and 60x20 cm, respectively. Supply of nutrients through Site specific nutrient management (SSNM) in safflower not only gave highest seed yield (1314 kg/ha) but it was also significantly higher by 11% over supply of 100% NPK (1002 kg/ha). Safflower - greengram recorded significantly highest SY (3391 Kg/ha.) followed by Safflower - Soybean system (3302 Kg/ha.). Among the plant spacings, 45X20 cm registered the maximum system yield in terms of Safflower equivalents (2750 Kg/ha.), while, 30X20 cm and 60X20 cm recorded on par values.

Image:





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Biogaraphy (150 word-limit mandatory)

DR. CHOURAT SUDHAKAR
PRINCIPAL SCIENTIST (AGRONOMY)
AGRICULTURAL RESEARCH STATION, TANDUR-501141,
PROFESSOR JAYASHANKAR TELANGANA STATE AGRICULTURAL UNIVERSITY
VIKARABAD DISTRICT, TELANGANA STATE, INDIA

Dr. Sudhakar Chourat has completed his Masters and Ph. D (Agronomy) from Acharya N. G. Ranga Agricultural University, Hyderabad, India during 1997 and 2011, respectively. He has been working as Principal Scientist (Agronomy) at Agricultural Research Station, Tandur (PJTSAU), Telangana State under All India Co-ordinated Research Projects on Sorghum and Safflower since 1998. He has more 13 years of research experience in Safflower crop. He has published about 25 research articles in reputed journals and conference papers to his credit of which, 3 papers being International conference Oral presentations. Besides, he authored 3 book chapters. His innovative research on transplanted in Pigeonpea has gained lot of popularity among the farming community. The ICRISAT is being utilizing his services as a subject matter specialist on Pigeonpea Production Technology during various occasions. He held the responsibility of Editor for the University Monthly Farm Magazine "*Vyvasaayam*" for a period of one year during 2009-10.

Email: chouratsudhakar@yahoo.com

Notes/Comments

Acknowledgement
Sincere thanks to Indian Council of Agricultural Research-All India Coordinate Research Project (Oilseeds)-Safflower, India for funding this research project.