Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 7 [7] June 2018 : 73-77

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.876
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Effect of Green Manuring, Spacing and Nitrogen Levels on Productivity of Greengram-Safflower Sequence

G.V. Venkataravana Nayaka[1] and G. Somanagouda[2]
[1]Department of Agronomy, Ph.D Scholar, S. V. Agricultural College, Tirupati, ANGRAU. A.P, India
[2]Junior Agronomist, Department of Agronomy, ARS, Annigeri, Karnataka, India
Email:- rahulnayaka9134@gmail.com

ABSTRACT
A field experiment entitled "Effect of green manuring, spacing and nitrogen levels on productivity of greengram-safflower sequence" was conducted at Agriculture Research Station, Annigeri, University of Agricultural Sciences, Dharwad during kharif and rabi seasons of 2014-15 under rainfed conditions. The experiment was laid out in a split-split plot design and replicated thrice. Main plot consist of three treatments, greengram as a green manuring and greengram as a dual purpose grown during kharif and one fallow. Succeeding safflower was sown during rabi season with two sub treatments of spacings (45 cm x 20 cm and 60 cm x 30 cm) and three sub sub treatments of nitrogen levels (20, 30 and 40 kg N/ ha). Among the main plot treatments greengram as a green manure resulted significantly highest seed yield (12.92 q/ha). While the lowest seed yield was recorded in fallow (11.09 q/ha), however the greengram as a dual purpose was on par with greengram as a green manuring (12.04 q/ha). Among the main plot treatments GM_2 recorded significantly higher net returns (35363 Rs./ha) and B : C ratio (2.53), as compared to rest of the treatments GM_1 and fallow (12191 Rs./ha and 13795 Rs./ha, respectively) and (1.61 and 1.99, respectively).
Key words: *Greengram, Green manuring, Dual purpose, Safflower, Seed yield*

Received 11.04.2018 Revised 10.05.2018 Accepted 23.05.2018

INTRODUCTION

In the present day agriculture, emphasis is being laid on the maximization of agricultural productivity per unit time through increasing soil fertility and productivity [7]. The choice of green manuring crops has to be made in relation to soil, climate and time available to raise the green manure crop. Leguminous green manuring crop fixes the atmospheric nitrogen in the soil in the available organic form, improves the soil health, physical structure, prevents leaching losses and conserves soil moisture [7]. Green manuring is a low cost effective technology in minimizing investment cost on chemical fertilizer, pesticides and other inputs, thus safeguarding the productive capacity of soil with minimum investment. A green manure cover crop, or plow down crop, is any crop that is turned into the soil to add organic matter, nitrogen or other nutrients. Such biomass can be either grown *in-situ* for incorporation or grown elsewhere and brought for incorporation in field to be manures. Leguminous plants are mainly used for green manuring due to their biological nitrogen fixation ability, drought tolerance, quick growth and adaptation to adverse conditions [7].

In Northern Dry Zone (Zone-3) of Karnataka, safflower is one of the important oilseed crop grown on residual moisture in vertisol. Farmers are practice fallow-safflower cropping system. In this system land is kept fallow during the *kharif.* It gives a chance to take up *in-situ* green manure in fallow land. These *in-situ* green manures produce an average 15-22 tonnes of green biomass which add about 5-7 tonnes of dry matter to the soil and enhance the soil fertility. This in turn increase the availability of nutrients in soils and crop productivity (improves the physical, chemical and biological properties of soil) Hence, the present experiment was planned to study the effect of green manuring, spacing and nitrogen levels on productivity of greengram-safflower sequence.

MATERIAL AND METHODS

The field study was conducted during *kharif* and *rabi* seasons of 2014-15 under rainfed conditions at the Agricultural Research Station, Annigeri, Dharwad. The experiment was laid out in a split-split plot design and replicated thrice. Main plot consist of three treatments, greengram as a green manuring (GM_1) and greengram as a dual purpose (GM_2) grown during *kharif* and one fallow (GM_3). Succeeding safflower was sown during *rabi* season. Two sub treatments spacings (S_1: 45 cm x 20 cm and S_2: 60 cm x 30 cm) and nitrogen levels (N_1: 20, N_2: 30 and N_3: 40 kg N/ha) were applied to succeeding safflower.

The greengram crop was sown with the onset of monsoon (12th June 2014) at row spacing of 30 cm with seed rate of 12.5 kg/ha. Greengram crop was given a common dose of fertilizer of 25:50:25 kg N: P_2O_5: K_2O/ha at the time of sowing. Green manure GM_1 *i.e.* incorporation of greengram as a green manure at full bloom stage (45-50 DAS) in field was done on 1st August 2014. And GM_2 greengram as a dual purpose *i.e.* incorporation after picking of pods was carried out on (20.08.2014). The rainfall received in the month of August (170.4 mm) and September (130.2 mm) ensured proper decomposition of green manure. The average annual rainfall of the year April 2014 to May 2015 (841.7 mm) with 52 rainy days. During *rabi* season, the safflower crop was sown on 20th October 2014. The safflower was harvested at 130 days after sowing. The rainfall received in the month of October (128.4 mm), November (23.6 mm) and December (18.6 mm) ensured adequate moisture in the soil which in turns helped for proper growth and development of crop.

RESULTS AND DISCUSSION

The performance of safflower was significantly influenced by incorporation of green manures (Table 2). Incorporation of greengram as a green manure resulted significantly highest seed yield (12.92 q/ha). While the lowest seed yield was recorded in fallow (11.09 q/ha), however the greengram as a dual purpose was on par with greengram as a green manuring (12.04 q/ha). Safflower yield was higher 16.50 per cent in GM_1 and 8.57 per cent in GM_2 as compared to fallow- safflower system (Table 2). Seed yield is a function of yield contributing characters of safflower. The improvement in seed yield of safflower in greengram as green manuring as well as greengram as a dual purpose crop was due to yield attributes *viz.,* number of capsules per plant (24.56 and 22.69, respectively), number seeds per capsules (26.11 and 25.00, respectively), seed weight per plant (15.07 g and 13.07 g, respectively) and test weight (5.91 g and 5.88 g, respectively) (Fig. 1 and 2). All these yield components were significantly higher with greengram as a green manuring crop than fallow. the higher yield parameters in these treatments was in turn due to higher growth characters of safflower such as plant height (80.73 cm and 79.58 cm, respectively), total number of primary branches (9.22 and 8.07, respectively) and secondary branches (16.98 and 15.29, respectively) in GM_1 and GM_2 (Table 1). These results corroborate with the findings of Yogesh (2013).

Among the green manure treatments GM_2 recorded significantly higher net returns (35363 Rs./ha) and B : C ratio (2.53), as compared to rest of the green manure treatments GM_1 (12191 Rs./ha and 1.61) and fallow (13795 Rs./ha and 1.99) respectively (Table 3). The higher net returns and B:C ratio of safflower was due to higher equivalent yield of safflower. These results are in line with the findings of Rajshekar *et al.* [5].

Effect of spacings on growth and yield of safflower

The performance of safflower was significantly influenced by adopting two different spacings. Between the spacings treatments, significantly higher seed yield was observed in 60 cm x 30 cm (12.77 q/ha) than the 45 cm x 20 cm (11.26 q/ha), which was 13.41 per cent higher in 60 cm x 30 cm compared to 45 cm x 20 cm (Table 2). Wide spacing produced the highest number of capsules per plant (24.09), number of seeds per capsules (25.85), test weight (5.95) and seed weight per plant (14.26) as compared with narrow one (Fig. 1 and 2). Due to the better environmental conditions in wide spacing and less competition between plants as well as increased light penetration within plant canopy which increased assimilation rate and oil formation. These results are in line with those obtained by Babak *et al.* [1] and Roqiyeh *et al.* [6].

Increased plant height with wider spacing (low density) may be due to increased light and decreased shadow, which permit auxin hormone to work together with gibberellin hormone to elongate the internal and this results in increasing stem growth. On the other hand, closer spacing (high density) leads to decreased light penetration to the vegetative parts of plant and cause photo destruction to oxygen which result in decreased plant height. With decreasing row spacing, seed yield per capsule generally tended to decrease. The yield per capsule reductions in safflower crop at high density can be explained by lower number of seeds per capsule (23.70), seed weight per plant (12.83) and test weight (5.63) (Fig. 1 and 2). Seed yield per capsule decreased with decrease row spacing, while total seed yield increased, this may be due to increase plant density which results in increased total seed yield as compared with seed yield per

capsule, as shown in (Table 2) This reduction in seed yield per capsule by increasing plant density (decreasing row spacing) has been verified in some studies Ozel *et al.*, [4].

Table 1: Effect of green manuring, spacing and nitrogen levels on growth parameters of succeeding safflower.

Treatment	Plant height (cm)	Primary branches plant^{-1}	Secondary branches plant^{-1}
Green manuring (GM)			
GM_1: Green gram (Green manuring)	80.73	9.22	16.98
GM_2: Green gram (Dual purpose)	79.58	8.07	15.29
GM_3: Fallow	73.39	7.83	14.90
S.Em±	2.24	0.22	0.42
CD (p=0.05)	6.72	1.20	1.80
Spacing (S)			
S_1: 45 cm x 20 cm	77.37	7.74	14.97
S_2: 60 cm x 30 cm	80.69	9.01	16.47
S.Em±	1.61	0.30	0.37
CD (p=0.05)	NS	1.02	1.28
Nitrogen levels (N)			
N_1: 20 kg N/ha (50% RDN)	74.00	6.79	13.73
N_2: 30 kg N/ha (75% RDN)	77.05	8.33	15.72
N_3: 40 kg N/ha (100% RDN)	82.64	10.00	17.71
S.Em±	2.32	0.29	0.39
CD (p=0.05)	6.78	0.85	1.13
Interaction (GM×S×N)			
S.Em±	5.69	0.72	0.95
CD (p=0.05)	NS	NS	NS

Table 2: Effect of green manuring, spacing and nitrogen levels on seed yield, stalk yield (q/ha) and harvest index of succeeding safflower

Treatment	Seed yield (q/ha)	Stalk yield (q/ha)	Harvest index
Green manuring (GM)			
GM_1: Green gram (Green manuring)	12.92	48.84	0.26
GM_2: Green gram (Dual purpose)	12.04	44.95	0.25
GM_3: Fallow	11.09	43.34	0.23
S.Em±	0.24	0.97	0.004
CD (p=0.05)	0.95	3.79	0.017
Spacing (S)			
S_1: 45 cm x 20 cm	11.26	42.20	0.25
S_2: 60 cm x 30 cm	12.77	49.22	0.25
S.Em±	0.24	0.93	0.005
CD (p=0.05)	0.82	3.21	NS
Nitrogen levels (N)			
N_1: 20 kg N/ha (50% RDN)	10.32	39.77	0.25
N_2: 30 kg N/ha (75% RDN)	11.31	44.60	0.24
N_3: 40 kg N/ha (100% RDN)	14.42	52.76	0.26
S.Em±	0.29	0.97	0.008
CD (p=0.05)	0.85	2.83	NS
Interaction (GM×S×N)			
S.Em±	0.72	2.38	0.019
CD (p=0.05)	NS	NS	NS

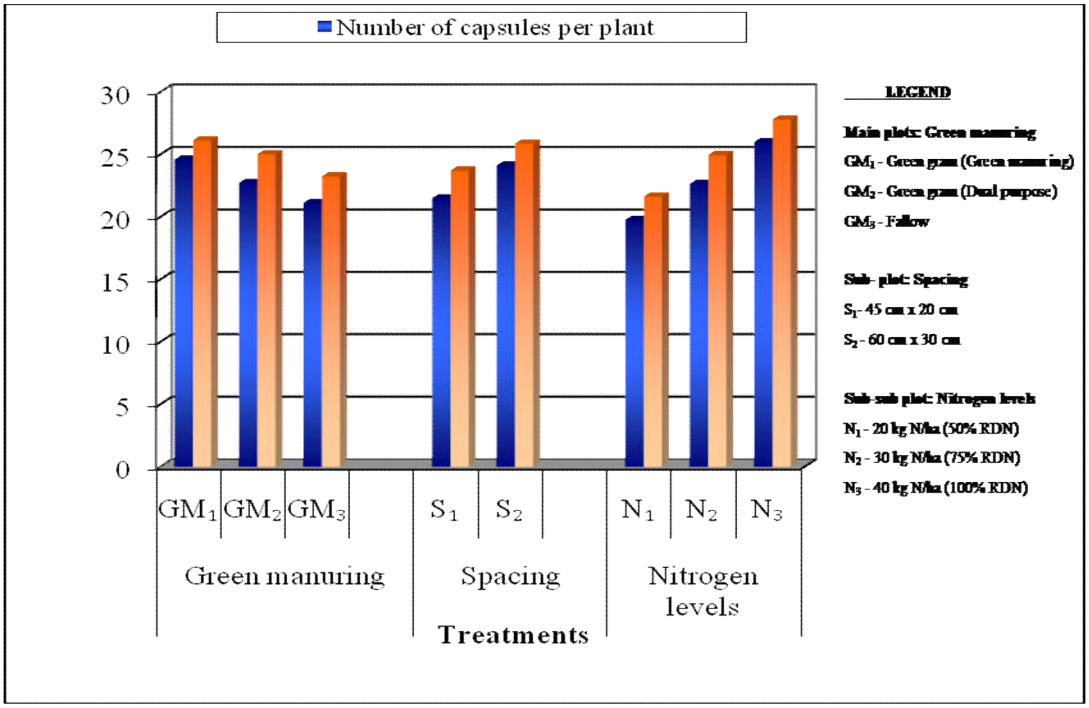
Effect of nitrogen on growth and yield of safflower

Nitrogen fertilization positively affected seed yield. Seed yield showed significant increase with increase in levels of nitrogen. Among the different nitrogen levels, significantly the highest seed yield was observed at 40 kg N/ha (14.42 q/ha) over the 30 kg N/ha (11.31 q/ha) and 20 kg N/ha (10.32 q/ha). And this was 39.72 per cent at 40 kg N/ha and 9.6 per cent at 30 kg N/ha higher compared to 20 kg N/ha (Table 2). These results conformed with the following findings of Vishwanath *et al.*, [8]. Differences in seed yield of safflower were mainly due to differences in yield contributing characters. The improvement

in seed yield with application of 40 kg nitrogen per ha was due to increase in yield attributing characters of safflower such number of capsules per plant (25.98), number seeds per capsules (27.78), seed weight per plant (14.61) and test weight (6.62) (Fig. 1 and 2). All these yield components recorded significantly higher value at 40 kg nitrogen per ha than the 20 kg nitrogen per ha. Similar increases in yield attributes with increasing levels of nitrogen were reported in safflower by Golzarfar *et al.*, [2]; Zareie *et al.*, [10]; and Mohamed *et al.*, [3].

Table 3: Effect of green manuring, spacings and nitrogen levels on gross returns, net returns and B:C ratio of succeeding safflower

Treatment	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
Green manuring (GM)			
GM_1: Green gram (Green manuring)	32292	12191	1.61
GM_2: Green gram (Dual purpose)	58463	35363	2.53
GM_3: Fallow	27714	13795	1.99
S.Em±	602	602	0.25
CD (p=0.05)	2364	2364	0.85
Spacing (S)			
S_1: 45 cm x 20 cm	37566	18526	1.94
S_2: 60 cm x 30 cm	41413	22373	2.14
S.Em±	591	591	0.28
CD (p=0.05)	2046	2046	NS
Nitrogen levels (N)			
N_1: 20 kg N/ha (50% RDN)	35200	16312	1.82
N_2: 30 kg N/ha (75% RDN)	37692	18651	1.94
N_3: 40 kg N/ha (100% RDN)	45578	26385	2.36
S.Em±	730	730	0.34
CD (p=0.05)	2131	2131	NS
Interaction (GM×S×N)			
S.Em±	1788	1788	0.91
CD (p=0.05)	NS	NS	NS



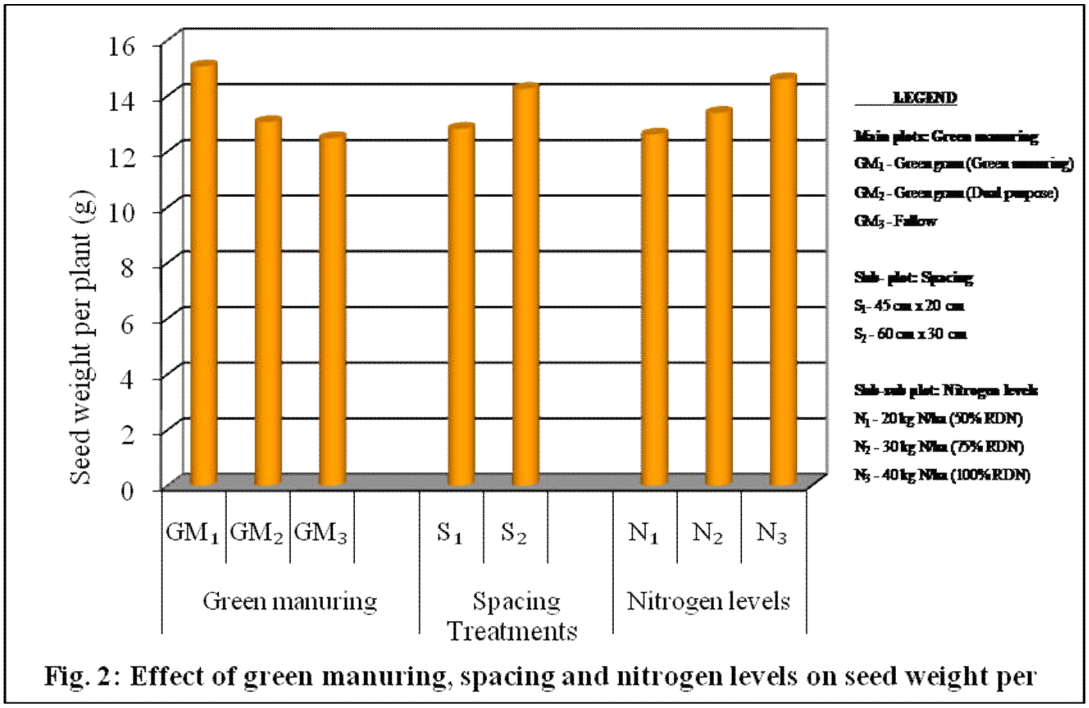


Fig. 2: Effect of green manuring, spacing and nitrogen levels on seed weight per

REFERENCES

1. Babak, Pasary, Ghorban and Noormohamadi, (2011). Evaluation of Growth Pattern, Seed and Flower Yield of Safflower Following Winter Crops. *Intl. Conf. on Asia Argil and Animal*. 13 IACSIT Press, Singapore. pp : 96-100.
2. Golzarfar, M., Shirani Rad, A. M. and Delkhosh, B., (2011). Nitrogen and phosphorus rates effect on yield and oil content of safflower in two growing season. *Intl. J. Sci. Adv. Technol.,* 1 (7) : 60-64.
3. Mohamed, S. J., Jellings, A. J. and Fuller, M. P., (2012). Effect of nitogen on safflower physiology and productivity. *African Crop Sci. J.,* 20 (4) : 225-237.
4. Ozel, A., Demirbilek, T. and Gur, M. T., (2004). Copur effects of different sowing date and intrarow spacing on yield and some agronomic traits of safflower (*Carthamus tinctorius* L.) under Harran Plain's arid conditions. *Turkish J. Agric. Forestry*, 28 : 413-419.
5. Rajshekar, M. G., Palled, Y. B. and Alagundagi, S. C., (2004). Performance of maize-lucerne intercropping system. *Karnataka J. Agric. Sci.,* 17 (2) : 196-202.
6. Roqiyeh, S. A., Ahmad,T. and Shahzad, J. S., (2012). Effect of plant density on yied and yield components safflower under irrigation and no irrigation condition. *Intl. J. Agric. Res. Rev.,* 2 : 1106-1116.
7. Virdi, K., Joshi, N. and Singh, S., (2005). Green manuring an alternate way to improve soil fertility. *Indian Farming,* April, pp. 19-21.
8. Vishwanath, H., Pujari, B. T., Prakash, S. S., Ramesh babu. And Deshmanya, J. B., (2006). Growth attributes, dry matter production and its partitioning and nutrient uptake studies in spainless safflower (*Cartamus tinctorious* L.) *var* NARI-6 as influenced by nitrogen and sulphur levels. *Karnataka. J. Agric. Sci.,* 19 (4) : 913-917.
9. Yogesh, T. C., (2013). Effect of In-situ green manuring of legumes, NP levels and organic manures on growth, yield and quality of safflower. *Ph. D. Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).
10. Zareie S., Golkar, P. and Mohammadi, N. G., (2011). Effect of nitrogen and iron fertilizers on seed yield and yield components of safflower genotypes. *African J. Agric. Res.,* 6 (16) : 3924-3929.

CITATION OF THE ARTICLE

G.V. Venkataravana Nayaka and G. Somanagouda· Effect of Green Manuring, Spacing and Nitrogen Levels on Productivity of Greengram-Safflower Sequence. Bull. Env. Pharmacol. Life Sci., Vol 7 [7] June 2018 :73-77