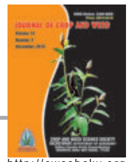
Journal of Crop and Weed, 19(1): 271-275 (2023)
ISSN- O : 2349 9400 ; P : 0974 6315

http://cwssbckv.org
www.cropandweed.com

Weed dynamics and soil health in green gram [*Vigna radiata* (L.) Wilczek] as influenced by crop geometry and foliar nutrition in southern coastal plains of Kerala

K. SOWMYA, *J.S. BINDHU, P. SHALINI PILLAI, D. JACOB AND R. GLADIS

Dept. of Agronomy, College of Agriculture, Vellayani, Kerala Agricultural University Thiruvananthapuram-695522, Kerala

Received : 05.12.2022 ; Revised : 14.01.2023 ; Accepted : 24.01.2023

DOI: https://doi.org/10.22271/09746315.2023.v19.i1.1690

ABSTRACT

A research experiment was carried ou at southern coastal plain of Varkala, Thiruvananthapuram, Kerala during 2021-22, to study the effect of crop geometry and foliar nutrition in green gram on weed dynamics and soil health. The experiment was done in split plot design replicated four times. The main plots were spacing, S_1- 25 cm × 15 cm with one seedling, S_2- 25 cm × 15 cm with two seedlings, S_3- 25 cm × 25 cm with one seedling and S_4- 25 cm × 25 cm with two seedlings. The sub plots were foliar nutrition, F_1 - Urea at 2%, F_2 - DAP at 2%, F_3 - KNO_3 at 0.5% and F_4 - DAP at 2% + KNO_3 at 0.5% at 15 and 30DAS. The study indicated that grasses were the predominant weed flora and the lowest weed density and dry weight were in 25 cm × 15 cm with two seedlings along with foliar application of DAP at 2%. The spacing of 25 cm × 15 cm showed more organic carbon and available nitrogen than 25 cm × 25 cm. Among the foliar nutrition, application of DAP at 2% showed more organic carbon and nitrogen status and for phosphorus and potassium, application with DAP at 2% + KNO_3 at 0.5% were the best. Growing green gram with close spacing of 25 cm × 15 cm along with foliar application of DAP at 2% or DAP at 2% + KNO_3 at 0.5% at 15 and 30 days after sowing were found promising for enhancing soil fertility in summer fallows.

Keywords: Crop geometry, foliar nutrition, green gram, spacing, summer fallows

Green gram [*Vigna radiata* (L.) Wilczek], the queen of pulses is a hardy crop suited for summer fallows of Kerala. Pulses have dual role in cropping system research due to soil fertility and nutritional security. In light of their inbuilt advantages, reduced reliance on external inputs, higher protein content and ecological security, including pulses in summer fallows must be seen as a long-term benefit for resource conservation. Growing green gram with conservative agriculture gives higher yield and profit in summer fallows (Behera *et al.,* 2014). Due to its rapid growth, high biomass and exceptional nutritional content as food and forage, it occupies prime position among pulses. Intensification of rice fallows may be a viable option for enhancing productivity in green gram.

Weeds cause considerable yield losses in green gram, which can range from 40 to 68 per cent (Tamang *et al.,* 2015). Due to the initial slow stature of green gram weed, appears faster and have more advantage over the crop weeds exert a dominant effect on the crop. Among the various cultural practice's choice of crop species, plant population, crop geometry, inter cropping and crop nutrition have profound effect on weed suppression. Increasing crop densities by adjusting plant population effectively reduces the niches available to weeds and lowered the weed density which has more impact in enhancing grain yield by conserving soil moisture, nutrients and sun light which helps in improving soil health. Thus, crop geometry had a major role in non-chemical weed management. Crop geometry of 25 and 50 cm have reduced weed dry matter when compared to wider spacing of 75 cm, when the field is kept weed free upto 30 DAS (Chauhan *et al.,* 2017). Application of nutrients through foliage at initial stages helps the plants to quickly absorb the nutrients at seedling and early vegetative stage and considered as one of the fastest ways to boost the productivity of pulses. In view of extending the beneficial effects of crop geometry with foliar nutrition in green gram for weed management and enhancing soil fertility in summer fallows, the study was carried out.

The study was conducted in summer fallows of farmers field at Varkala, Southern coastal plain (AEU I), Thiruvananthapuram district, Kerala (8° 43' 11" N and 76 45' 50" °E longitude; 52 m above MSL. The soils of the experimental site were clay loamy nature. The soil of the experimental site was strongly acidic, non-saline, high soil organic carbon, high available P with medium available N and K. The experiment was conducted during February to May, 2022 after the

Short Communication
Email: bindu.js@kau.in
How to cite : Sowmya, K., Bindhu J. S., Shalini Pillai, P., Jacob, D. and Gladis, R. 2023. Weed dynamics and soil health in green gram [*Vigna radiata* (L.) Wilczek] as influenced by crop geometry and foliar nutritionin southern coastal plains of Kerala. *J. Crop and Weed*, 19(1): 271-275.

harvest of *rabi* rice. The range of temperature during the crop period was from 21.3°C to 33.9°C. The total rainfall received was 177.40 mm. Split plot design was followed, i was replicated four times. The main plots were spacing, S_1- 25 cm × 15 cm with one seedling, S_2 -25 cm × 15 cm with two seedlings, S_3 - 25 cm × 25 cm with one seedling and S_4- 25 cm × 25 cm with two seedlings Thinning were done to maintain plant population at 7DAS. The sub plots were foliar nutrition, F_1 - Urea at 2%, F_2 - DAP at 2%, F_3 - KNO_3 at 0.5% and F_4 - DAP at 2% + KNO_3 at 0.5%. Foliar nutrition was done at 15 and 30 DAS. Green gram variety 'CO 8' from TNAU was used for the study. As per KAU (2016), all other cultivation practices were followed to raise green gram.

Weed parameters such as flora, density, and dry weight of weeds were made at 15 days interval upto flowering (Table 1). The different weeds of the study area were identified and recorded. By quadrat method (0.5 m × 0.5 m) density and dry weight were calculated. Standard procedures were followed for estimating organic carbon, available NPK and nutrient uptake at harvest. The data tabulated were statistically analysed and means were compared at 5% significance (Gomez and Gomez, 1984).

Twelve weed species were observed in field. Crop weed flora varies according to agro-ecological units and crop management practices (Sarin *et al.,* 2021). The predominant weed species were grassy weeds. The predominant species among grasses were *Oryza sativa, Echinochloa colona, Eleusine indica* and *Digitaria ciliaris.* Among broad-leaved weeds, *Cleome viscosa, Melochia corchorifolia, Mimosa pudica* and *Evolvulus nummularis* and *Cyperus iria* was the only sedge observed. An aquatic water fern *Marselia quadrifolia* was also observed. The grasses were the predominant weed species in green gram when grown in rice-based fallows (Abid *et al*., 2018).

The analysed data revealed that during early stages of growth no treatment difference were observed. But at flowering stage it was influenced by plant population and foliar nutrition. Weed density was lower (9.75 m^{-2}) with S_2. This might be due to competition for the natural resources among inter plant population and weeds. Weed reduction in closer spacing may be due to high crop cover, less light penetration. This helps in checking the weed seed germination and growth (Singh and Singh, 2020). Weed density was higher (15.94 m^{-2}) with S_3. Foliar nutrition with DAP at 2% (F_2) recorded reduced weed density (10.94 m^{-2}) and it was on par with KNO_3 at 0.5% (F_3). The favourable effect of foliar application of fertilizers on green gram may be due to improved partitioning of photosynthates. The higher weed population (15.56 m^{-2}) was observed with urea at 2% (F_1).

The lowest dry matter (18.54 g m^{-2}) was in S_2. The highest dry matter (28.92 g m^{-2}) was in S_3 and it was statistically on par with S_1. Broad spacing might have received more photosynthetically active solar radiation which stimulates the vigorous weed growth resulted in higher population and dry matter. These are in line with Aslam *et al*. (2007). Among the foliar nutrition treatments, urea at 2% (F_1) and DAP at 2% (F_2) recorded the highest and lowest dry matter of 29.62 and 19.36 g m^{-2}, respectively. The nitrogen source in urea may cause more vegetative growth thus, resulted in high dry matter production.

One seedling per hill recorded more seed yield than two seedlings per hill (Fig.1). This may be due to less competition among the inter plant population for growth resources. Among the foliar nutrition, KNO_3 @ 0.5% (F_3) recorded more seed yield and was at par with DAP @2% + KNO_3@0.5% (F_4). Similar trends were also observed for haulm yield.

Higher NPK uptake was observed with S_1 and S_3 (Table 2). These treatments have showed high yield which might have resulted in higher nutrient uptake by the plant. Among the foliar nutrition, higher N and P uptake was observed with DAP @2% + KNO_3 @0.5% (F_4), with 49.60 and 10.11 kg ha^{-1}, respectively. K uptake (27.07 kg ha^{-1}) was higher with KNO_3 @ 0.5% (F_3) and was at par with F_4. It may be due to effective translocation of multi nutrients applied *via* crop canopy, leading to produce more functional root nodules thus resulting in more uptake of nutrients. With increased photosynthetic efficiency, assimilation and partitioning of dry matter production was also higher (Amjad *et al.,* 2004). This can also be due to low crop weed interference in these treatments.

The available nutrient status after the experiment was shown in Table 2. Growing of legumes in third crop season improves the organic carbon and available nutrients in the soil (Jensen *et al*., 2012). Spacing of 25 cm × 15 cm recorded more organic carbon (1.48%) than 25 cm × 25 cm. This may be due to more plant population coupled with left over rice residue. Application of DAP at 2% (F_2) recorded higher value (1.57 %) which was on par with urea at 2% (F_1). The higher organic carbon status of soil with application of nutrients through foliage was also reported (Bochalya *et al*., 2021).

Abid (2017) reported that inclusion of green gram in summer fallows increased the NPK content of the soil after the experiment. Higher soil available N and K with the values of 378.06 and 193.60 kg ha^{-1}, respectively was recorded in S_1 and it was found to be at par with S_2; whereas higher available soil P (112.42

Table 1: Effect of crop geometry and foliar nutrition on weed density and weed dry weight of green gram

Treatments	Weed density (No. m^{-2})			Weed dry weight (g m^{-2})		
	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS
Spacing (S)						
S_1-Spacing of 25 cm × 15 cm with single seedling per hill	6.31	10.88	14.44	0.95	16.02	27.37
S_2 - Spacing of 25 cm × 15 cm with double seedling per hill	5.44	9.25	9.75	0.92	15.59	18.54
S_3 -Spacing of 25 cm × 25 cm with single seedling per hill	5.88	9.88	15.94	0.84	15.76	28.92
S_4- Spacing of 25 cm × 25 cm with double seedling per hill	6.00	9.94	13.00	0.94	15.14	22.99
SEm (±)	**0.40**	**0.60**	**0.46**	**0.10**	**1.57**	**0.76**
LSD (0.05)	**NS**	**NS**	**1.468**	**NS**	**NS**	**2.421**
Foliar Nutrition (F)						
F_1 - Urea at 2%	6.13	10.25	15.56	0.90	15.77	29.62
F_2 - DAP at 2%	5.56	10.00	10.94	0.93	15.39	19.36
F_3 - KNO_3 at 0.5%	5.88	9.63	11.69	0.89	15.18	23.02
F_4 - DAP at 2% + KNO_3 at 0.5%	6.06	10.06	14.94	0.93	16.17	25.82
SEm (±)	**0.40**	**0.55**	**0.45**	**0.07**	**1.26**	**0.61**
LSD (0.05)	**NS**	**NS**	**1.296**	**NS**	**NS**	**1.762**

Table 2: Effect of crop geometry and foliar nutrition on soil fertility and nutrient uptake of green gram in summer fallows

Treatments		Soil analysis			Nutrient uptake		
	Soil organic carbon (%)	Available nitrogen (kg ha^{-1})	Available phosphorus (kg ha^{-1})	Available potassium (kg ha^{-1})	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
Spacing (S)							
S_1- Spacing of 25cm × 15 cm with single seedling per hill	1.48	378.06	76.22	193.60	48.27	9.14	30.47
S_2 - Spacing of 25cm × 15 cm with double seedling per hill	1.44	363.68	111.35	189.17	47.31	7.34	21.65
S_3 -Spacing of 25 cm× 25 cm with single seedling per hill	1.34	331.47	112.42	161.68	39.74	8.35	25.21
S_4- Spacing of 25 cm × 25 cm with double seedling per hill	1.25	321.60	86.46	153.41	30.64	6.34	13.19
SEm (±)	**0.04**	**7.59**	**3.09**	**2.29**	**1.74**	**0.39**	**1.53**
LSD (0.05)	**0.116**	**24.284**	**9.878**	**7.327**	**5.564**	**1.251**	**4.912**
Foliar Nutrition (F)							
F_1 - Urea at 2%	1.44	379.40	80.35	158.74	40.96	5.96	19.14
F_2 - DAP at 2%	1.57	451.89	82.24	163.41	32.45	6.81	17.24
F_3 - KNO_3 at 0.5%	1.31	297.53	110.43	184.32	42.94	8.29	27.07
F_4 - DAP at 2% + KNO_3 at 0.5%	1.20	265.99	113.42	191.39	49.60	10.11	27.06
SEm (±)	**0.06**	**4.96**	**2.47**	**2.33**	**2.25**	**0.31**	**1.04**
LSD (0.05)	**0.171**	**14.230**	**7.080**	**6.692**	**6.451**	**0.883**	**2.984**

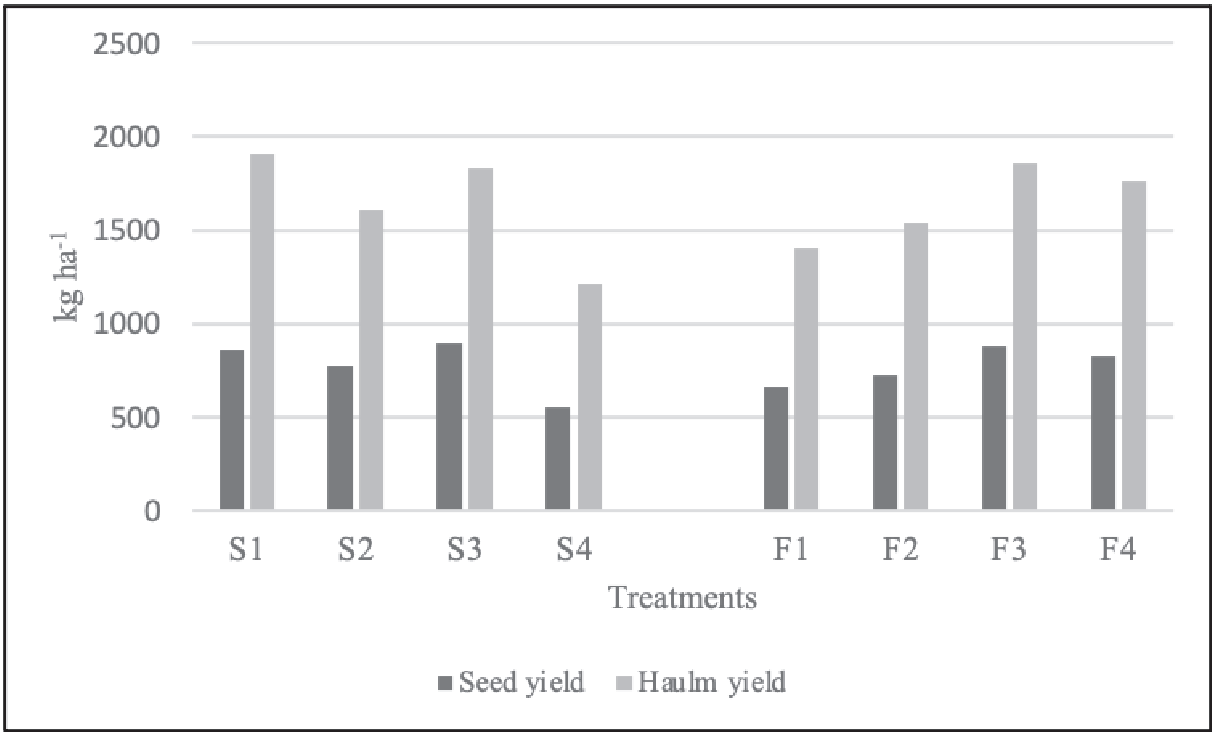


Fig.1: Influence of crop geometry and foliar nutrition on seed and haulm yield of green gram

kg ha^{-1}) was observed with S_3 and it was on par with S_2. The treatments with more plant population were reported to have higher soil NPK, this may be due to high plant density, extensive tap root system with minimum weed interference. The sustainable crop intensification with green and black gram in summer fallows lead to a positive build-up of nitrogen (Bindhu *et al.*, 2014). Available NPK was found to be higher in these treatments with higher organic carbon, may be due to better fixation of atmospheric nitrogen. Sakin (2012) also reported that soil organic carbon influence has a positive influence on nitrogen content. Among the foliar nutrition treatments, DAP @2% (F_2) and DAP @2% + KNO_3 @0.5% (F_4) had the synergistic effects on NP and NPK positive nutrient interactions, which might have promoted growth parameters, wider root proliferation and development thus helped in greater mobilization of available nutrients. These findings are in conformity with Jagtap *et al.* (2021). This can also be correlated with more plant population accompanied with more nodule number which might have contributed to greater rhizo-deposition.

Based on the above study, it can be inferred that planting green gram with 25 cm × 15 cm by maintaining one or two seedlings per hill followed by foliar application of DAP at 2% or DAP at 2% + KNO_3 at 0.5% at 15 and 30 days after sowing were found promising for weed management and soil fertility enhancement in summer fallows.

REFERENCES

Abid, V., Bindhu, J.S., Prameela, P. and Thomas C.G. 2018. Performance of green gram, *Vigna radiata* (L.) Wilczek cultivars under different tillage methods. *J. Crop Weed*, **14**: 178-184.

Abid, V. 2017. Performance of green gram (*Vigna radiata* (L.) Wilczek) cultivars under different tillage methods. M.Sc. (Ag) Thesis, Kerala Agricultural University, Thrissur, 146p.

Amjad, M., Anjum, M.A. and Akhtar, N., 2004. Influence of phosphorus and potassium supply to the mother plant on seed yield, quality, and vigour in pea (*Pisum sativum* L.). *Asian J. Plant Sci.,*

Aslam, M., Ahmah, H.K., Ahmad, E., Himanatullah., Khan, M.A. and Sagoo, A.G. 2007. Effect of sowing method and weed control techniques on yield and yield components in Chickpea. *Pakist. J. Weed Sci. Res.* **13**: 49-61.

Behera, U. K., Mishra, A. K., Bishoyi, B. S., Behera, S. K., Nayak, R. N., Ronanki, S. and Singh, S. 2014. Introduction of pulse crop in rice-fallow system through use of conservation agriculture practices in western Odisha. *J. Soil Water Conserv.,* **13**: 318 - 323.

Bindhu, J.S., Raj, S.K. and Girijadevi, L. 2014. Sustainable system intensification of sesamum (*Sesamum indicum*) through legume intercropping in sandy loam tract of Kerala. *J. Crop Weed*, **10**: 38-42.

Bochalya, R. S., Gupta, A. K., Sharma, B. C., Puniya, R., Thakur, N. P. and Singh, M.S.P. 2021. Residual effect of biofertilizer consortium and foliar nutrition on soil chemical properties after harvest of black gram crop as affected by different fertility levels under subtropical condition of Jammu. *Pharma Innov. J.,* **10**: 605-608.

Chauhan, B.S., Florentine, S.K., Ferguson, J.C. and Chechetto, R.G. 2017. Implications of narrow crop row spacing in managing weeds in mungbean (*Vigna radiata*). *Crop Prot.,* **95**: 116–119.

Jagtap, P., Ilhe, S.S. and Basawraj. 2021. Effect of foliar application of potassium on growth and yield of summer green gram (*Vigna radiata* L. Wilczek). *Curr. Adv. Agric. Sci.,* **13**: 128-130.

Jensen, E.S., Peoples, M.B., Boddey, R.M., Gresshoff, P.M., Hauggaard-Nielsen, H., Jr. Alves, B. and Morrison, M.J. 2012. Legumes for mitigation of climate change and the provision of feedstock for biofuels and biorefineries. A review. *Agron. Sustain. Dev.,* **32**: 329-364.

KAU [Kerala Agricultural University]. (2016). Package of Practices Recommendations: Crops (15th Ed.). Kerala Agricultural University, Thrissur. 392p.

Sakin, E. 2012. Organic carbon organic matter and bulk density relationships in arid-semi arid soils in Southeast Anatolia region. *Afr. J. Biotechnol.,* **11**: 1373-1377.

Sarin, S., Bindhu, J. S., Girijadevi, L., Jacob, D. and Mini, V. 2021. Weed management in summer groundnut (*Arachis hypogaea* L.). *J. Crop Weed*, **17**: 272-277.

Singh, R. and Singh, G. 2020. Weed management in green gram: A review. *Indian J. Weed Sci*. **52**:10-20.

Tamang, D., Nath, R. and Sengupta, K. 2015. Effect of herbicide application on weed management in green gram [*Vigna radiata* (L.) Wilczek]. *Adv. Crop Sci.Tech*.,3: 163. Available: http://163.doi:10.4172/2329-8863.1000163 [21 Dec. 2016].