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Demonstration of line sowing method in greengram in Nellore dist., A.P.

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Abstract
In addition to tur and blackgram, greengram (Mungbean) is an essential pulse crop in India. District produces less greengram than state and national averages. Since domestic demand is larger, greengram is imported. Considering the agronomic constraints to improve the production and attain higher yields crop production discipline of Krishi Vigyan Kendra, Nellore district conducted frontline demonstrations on greengram covering an area of 20 acres in Bukkapuram, Velagapadu, Laxmipuram, Anathapuram, and Komarikonduru villages during 2017-18 and 2018-19 to compare line sowing with broadcasting. Line sowing method recorded 182.1% higher yield than farmers' practice (193.3 kg/ha) and also obtained higher Benefit: Cost ratio of 1.81 which was higher than farmer practice where they got only 1.41. Line sowing method boosted crop yield and yield-attributing features compared to broadcasting. Thus, farmers must be educated about line sowing through training and demonstrations. To increase profits, farmers should use line sowing. During experimental period the technology gap is 12.5-18.5 and technology index varied from 58.36 to 74.

Keywords: Line sowing, benefit, cost ratio, higher returns, technology gap, technology index

Introduction
The Indian pulse crop greengram is very important. Different parts of the country grow it. The greengram is used for different things all over India, major portion is utilized in making dal, soup, sweets and snacks. In India, greengram is grown on 34.5 million hectares, and it produces 15.91 million tonnes with productivity of 461 kg/ha. In Andhra Pradesh, pulse crops made up 18.16% of the total cropped area and 32.94% of the total area used for food grain crops in 2018-19. Regarding production 7.40 lakh tonnes of production of pulses produced in the State during 2018-19. The production under Bengalgram, Blackgram, Redgram and Greengram together accounted for 92.43% of the total production of pulses. It has a significant impact on the incomes of small and marginal farmers in Andhra Pradesh. In Andhra Pradesh 0.84 lakh tonnes of greengram is produced over an area of 1.21 lakh hectare, with productivity of 701 kg/ha which is higher than that of Nellore district productivity (ASG 2018) [1]. In the key pulse-producing regions of Nellore district, structured personal interviews were performed as part of a survey aimed at determining the leading cause of yield decline. According to the results of the survey, the main reasons for green gram's low productivity are climatic aberrations, lack of availability of improved varieties and quality seed, poor agronomic and plant protection managements. Similar reasons were encountered with Sengupta and Biswas, 2017 [10]. Farmers in Nellore district usually follow broadcast method of sowing as the cost involved in sowing is very less as compared to line sowing but Inconsistent seed distribution caused by board casting results in strong competition among plants in one section and no competition at all in other areas of the field. Broadcasting is usually practiced where there is uneven soil tilth, although it takes less time and effort in sowing the seed but it leads to poor performance of the crop ultimately resulting in poor yields (Hunt, 1999) [5]. Increase in yield can be ensured by maintaining the optimum plant population through line sowing method. It is an established fact that the plant population should be kept optimum to obtain high grain yield. Broadcasting is the principal method of greengram sowing, which is usually practiced by farmers. Because seeds are distributed randomly in broadcasting, it is one of the yield-limiting factors. Line sowing also increases the efficiency of resources such as sunshine, water, air, and space, resulting in higher crop yield, profitability, and resource utilisation efficiency. Seed rate effects yield and yield characteristics (Kolarik and marek, 1980) [6]. Up to a certain point, grain yield increased with increasing seeding rate; thereafter, yield tended to decline (Svoboda, 1984; and Chen *et al*., 1992) [11, 2].

Seed rate plays a vital role in the growth and development of a crop by altering plant density and, in turn, moisture, nutritional, and space availability in order to maintain an optimal plant population. Keeping this in mind present study has been undertaken to evaluate line sowing method of sowing vis-a-vis broadcasting method of sowing followed by the local farmers in green gram crop.

Materials and Methods

The study was carried out in major green gram growing areas which are located withing the operational area of Krishi Vigyan Kendra (KVK), Nellore located in Andhra Pradesh. Thirty front line demonstrations were conducted on green gram crop in 5 villages over the period two years i.e., 2017-18 to 2018-19 to evaluate impact of line sown method on growth and yield parameters and in-turn its effect on yield. For implementing line sowing method, a seed drill was brought on loan basis from custom hiring center, available nearest to village. Farmers were trained to run seed drill, maintain tilth of the soil and seed rate while running the seed drill. Line sowing method and farmer practice – broadcasting method of sowing was conducted on a 1-acre plot each per demonstration in frontline demonstration. 30 x 10 cm spacing was maintained in Line sowing method. Sowing was done during 1st FN of October to 1st FN of November with seed rate of 15 kg/ha. Agronomic managements such as thinning (within 10 to 15 days after sowing), weeding (35 to 40 days after sowing) and plant protection measures were applied as per the package of practices in both demo and farmer's practice. The purpose of the performance review was to examine the differences between the potential yield and demonstration yield, extension gaps, and the technology index. In the present study, data on the yield of the greengram crop were collected from FLD plots. Additionally, data on the local methods widely used by farmers in this region were collected in order to calculate the technology gap, extension gap, and technology index using appropriate formulas (Naik *et al*., 2015 and Meena and Singh, 2017) [8, 7]. For the purpose of estimating the technology gap, extension gap, and technology index, the following formulas developed by Samui *et al*. (2000) [9] were utilised:

Technology gap = Pi (Potential yield) - Di (Demonstration yield)

Extension gap = Di (Demonstration Yield) - Fi (Farmers yield)

$$\text{Technology index} = \frac{\text{Technology gap}}{\text{Potential yield}} \text{X } 100$$

Results and Discussion

The results showed that the greengram growers of Nellore Dist. were encouraged by the frontline demonstrations and embraced the line sowing approach.

Influence of sowing method on growth parameters

Line sowing method has negative influence on plant height but there was significant positive influence on number of branches/plant and an increase in 27.78% observed over the farmer's practice. This may be due to uneven distribution of seeds and high seed rate in broadcasting lead to more population at one spot and less population on other spot which may resulted congested situation this led to less branching and tall plants but whereas in line sowing plant utilized more space and resulted in more number of branches compared to broadcasting method of sowing. Similar findings were recorded with Damte B G (2021) [3], Hamid *et al.* (2002) [4] and Hunt, D. (1999) [5]. Although in broadcasting method farmers used high seed rate compared to line sowing method but the population at harvest was not sustained that rationally this may be due to sowing depth. Usually in regard to sowing depth greengram should be sown between 2.5 to 5 cm depth but should not be sown further deeper than 5 cm. In broadcasting method of sowing, seeds were not placed properly at specified depth which inhibited the germination of the seed in-turn resulted in plant population compared to the seed rate applied.

Sowing method impact on yield and yield attributes

Line sowing method has recorded significantly higher yield attributes i.e., number of filled pods/plant (15.5), number of seeds/pod (13.5) which was 47.62% and 43.63% respectively higher than that of the broadcasting method of sowing. This increase in yield parameters is due to uniformity in distribution of seed in line sowing with recommended seed rate which lead harness the space, nutrient and sunlight etc. resulted in a greater number of filled pods and number of seeds/plant. In broadcasting method, high seed rate was used of sowing resulted in linear increase in the plant population but curvilinear decrease in number of filled pods/plant. In broadcasting method there were more number of unfilled pods/plant this is due to competition among the plants for sunlight and nutrients. Line sowing method resulted in higher seed yield (771 kg/ha) of 20.47% over the broadcasting method this may be due to contribution made by yield attributed. Where in case of stover yield, high population density was noticed in broadcasting method, which lead to severe competition within the plants and weed which lead to weak growth of plant, hence there was a reduction of 11.49% in stover yield compared to line sowing method (2140 kg/ha). According to Ballock *et al*., (2002) [12], wider spacing has a linearly increasing effect on individual plant performance because it draws more nutrients from the environment and more solar radiation for a better photosynthetic process, which results in more growth parameters such as no of branches/plant and yield attributes than dense once. As total biological yield was highest in the line sowing method it in-turn resulted in highest Harvesting index i.e., 26.49%.

Table 1: effect of sowing methods on growth, yield attributes and yield of greengram (mean of two years)

S. No.	Parameters	Demo	Check	% Increase	CD at 5%
1	Plant population at harvest	27.5	31	-11.29	S
2	Plant height at harvest (cm)	28.4	30.8	-7.79	S
3	Number of branches / plants	4.6	3.6	27.78	S
4	Number of filled pods/plant	15.5	10.5	47.62	S
5	Number of unfilled pods/plants	1.5	3.2	-53.70	S
6	Number of seeds/plants	13.5	9.4	43.62	S
7	100 seeds weight	4.36	4.21	3.56	NS
8	Seed yield (kg/ha)	771	639.5	20.47	S
9	Stover yield (kg/ha)	2140	1920	11.46	S
10	Biological yield (kg/ha)	2911	2560	13.71	S
11	Harvest index (%)	26.49	25.00	5.94	S

Influence of sowing method on economics

Adoption of a line sowing method is based only on its economic viability, as shown in Table 2. The broadcasting method of sowing resulted in the highest cost of cultivation compared to the line sowing approach. In broadcast method of

sowing though the initial cost for sowing operation was low compared to line sowing but overall cost of cultivation involved in broadcasting was higher as weeding should be done through manual due to uneven distribution of seeds but in line sowing inter-cultivation was done, which saved lot of investment as now a days due to less availability agricultural labour manual weeding is very expensive. In broadcasting severe pest and disease infestation was observed due to high population densities at some localities and this led to high investment on plant protection activities. The maximum gross returns (Rs. 40,140/-) and B:C ratio (1.81) was recorded in line sowing method as compared to broadcasting method of sowing (Rs. 33,273/- and 1.41 respectively).

Table 2: Effect of sowing methods on economics of greengram (mean of two years)

S. No.	Parameters	Demo	Check	% Increase
1	Gross returns (Rs/ha)	40,180/-	33,273/-	20.76
2	Cost of cultivation (Rs/ha)	22,142/-	23,500/-	-5.78
3	B:C Ratio	1.81	1.41	28.47

Impact of sowing method on extension gap, technology gap and technology index

An average extension gap of 131.5 kg/ha was recorded during the two years of experimentation, hence to reduce the gap it is need to educate the famers through various means for adoption of line sowing technology. Eventually, the adoption of line sowing will cause farmers to abandon the practise of broadcasting. The technology index indicates the viability of the developed technology on the farm. The lower the technology index value, the more feasible the technology. The average technology index was 48.6 percent. In Nellore district, mostly small and marginal farmer exist where they have several limitations that influence growth and yield negatively, hence the actual yields are less than its genetic potential.

Table 3: Gap analysis of frontline demonstrations in greengram

S. No	Year	Area (ha)	Seed Yield (kg/ha)			Technology Gap (kg/ha)	Extension Gap (kg/ha)	Technology Index (%)
			potential	Demonstration	Control			
1	2017-18	4.0	1500	652	519	848	133	56.53
2	2018-19	4.0	1500	890	760	610	130	40.67
Average			1500	771	639.5	729	131.5	48.6

Conclusion

Adoption of line sowing method resulted in high yield and returns per rupee investment this is due to increase in water use efficiency and fertilizer efficiency. As in line sowing, inter-cultivation is done for weeding which lead to mitigating labour shortage and reducing cost of cultivation in by avoiding expensive manual weeding. Farmers of Nellore Dist. are now interested to adopt line sowing method of sowing by keeping the yields and economics in consideration.

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