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Yield Gap Analysis through Cluster Front Line Demonstration in Blackgram at Tiruchirapalli District

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ABSTRACT

Background: Black gram is one of the important crops among the pulses. Rice-blackgram cropping system is very common in Tamil Nadu. The traditional practice of broadcasting of seeds in the standing crop of rice does not ensure uniform plant population and moisture which results in poor crop growth and yield. Technology gap is a major problem in increasing blackgram production in Tiruchirapalli district of Tamil Nadu State. So far, no systematic effort was made to study the technological gap existing in various components of blackgram cultivation. This project was implemented in Krishi Vigyan Kendra (KVK) with main objective to increase the production and productivity through cluster frontline demonstrations (CFLDs) with latest technologies.

Methods: The cluster front line demonstration s were conducted with the objective of increase in pulse production. The five village of fifty nine frontline demonstrations on blackgram (MDU-1) variety was laid out in an area of 50 hectares in farmer's field in Ayelapettai, Jadamangalam, Sirugamani, Peruvanallur and Anjalam of Tiruchirapalli district in Tamil Nadu. The inputs i.e. distributed are blackgram (MDU-1) variety seed along with mechanized sowing,

Result: There was 81.50 per cent increase in yield observed in demonstration plot over farmers' practice. It was observed that potential yield can be achieved by imparting scientific knowledge to the farmers, providing the quality need based inputs and proper application of inputs. Combination of technical inputs *viz*., designer seeds, application of TNAU pulse wonder and biofertilizers with scientific interference have increased the potential yield of a crop.

Key words: Blackgram, Cluster front line demonstration, Productivity.

INTRODUCTION

Black gram (*Vigna mungo* L.) is a short duration crop which belongs to the leguminacae family. Black gram is rich in protein (25-26%) and grown as intercrop, catch crop and also as a solo crop. It is also called as Urd bean. In India the area under black gram cultivation is 3.30 million ha producing 1.60 million tonnes, with the mean productivity of 0.49 kg ha^{-1} and contributes 11% of total production in the country. Black gram is one of the important crops among the pulses. Rice-blackgram cropping system is very common in Tamil Nadu. It contributes to over 70% of total food grain production in the country with an area of 12 M ha under this cropping system. This cropping system is also most predominating in Tamil Nadu, which occupies 65% of total cultivated area. Thus, it is necessary that production of rice and blackgram must keep pace with the growing population of our country. The traditional practice of broadcasting of seeds in the standing crop of rice does not ensure uniform plant population and moisture which results in poor crop growth and yield.

However there is still a wide gap between the productions. Potential and the actual production realized by the farmers. This may be due to partial adoption of recommended package of practices by the blackgram growers. Technology gap is a major problem in increasing blackgram production in Tiruchirapalli district of Tamil Nadu State. So far, no systematic effort was made to study the technological gap existing in various components of blackgram cultivation. This project was implemented in Krishi Vigyan Kendra (KVK) with main objective to increase the production and productivity through cluster frontline demonstrations (CFLDs) with latest technologies.

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MATERIALS AND METHODS

The present investigation of cluster front line demonstrations was conducted during summer season 2015-2016 to 2019-2020 by the Krishi Vigyan Kendra (KVK), Tiiruchirapalli. The five villages of fifty nine frontline demonstrations on blackgram (MDU-1) variety was laid out in an area of 50 hectares in farmer's field in Ayelapettai, Jadamangalam, Sirugamani, Peruvanallur and Anjalam of Tiruchirapalli district in Tamil Nadu.

The cluster front line demonstrations were conducted with the objective of increase in pulse production. The inputs *i.e.* distributed are blackgram (MDU-1) variety seed along with mechanized sowing, *i.e.*, seed drill was calibrated for blackgram using the metering mechanism provided in the seed drill. Zero-till ferti seed-drill utilizes a different type of furrow opener which makes slit in untilled soil without much disturbing it. The recommended seed rate of 8 kg seed was sown according to 30 cm row to row spacing and before sowing the seed was soaked for 30 minutes to maintain uniform moisture content of the seed. The soil moisture content at the time of sowing was 25 per cent.

The following materials and technologies were demonstrated by the KVK for conducting FLDs to the farmers (Table 1). The input materials provided to the farmers and they were trained to follow the package and practices for blackgram cultivation as recommended by the Tamil Nadu Agricultural Universities. The farmers followed the full package of practices like seed treatment, bio fertilizer inoculation, fertilizer application, water and weed management, insect-pest management *etc.* In case of local check, the traditional practices were followed in existing varieties by the farmers. The yield data were collected from both cluster FLD plots as well as farmers practice plot (local check) and compiled results has been given in Table 2. The conventional broadcast method as treated as control. The following parameters were calculated based on the formulas, (Samui *et al.* 2000).

Table 1: Details of cluster frontline demonstrations conducted by the KVKs of blackgram in different block during summer 2015-16 to 2019-2020.

Crop	Demonstrated technology	Block
Blackgram	• Soil health management • Seed treatment • Mechanized sowing • Integrated nutrient management • Intergarted pest and disease management • Irrigation management • Harvesting management • Post harvest management	Ayelapettai, Jadamangalam, Sirugamani, Peruvanallur and Anjalam

Economic returns and B: C ratio

The gross, net returns and B: C ratio were calculated as follow:

Gross returns (Rs. ha^{-1}) = Yield (kg ha^{-1}) × Price of produce (Rs. kg^{-1})

Net returns (Rs. ha^{-1}) = Gross returns (Rs. ha^{-1}) - Cost of cultivation (Rs. ha^{-1})

$$\text{Benefit cost ratio} = \frac{\text{Gross returns (Rs. ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs. ha}^{-1}\text{)}}$$

Extension gap = Demonstration yield-Farmers yield

RESULTS AND DISCUSSION

The five villages of fifty nine Frontline demonstrations on blackgram (MDU-1) variety was laid out in an area of 50 hectares in at fifty nine farmers' fields in Ayelapettai, Jadamangalam, Sirugamani, Peruvanallur and Anjalam of Tiruchirapalli district in Tamil Nadu. The inputs provided to the farmers for laying the demonstrations were eight kg of designer seed with mechanized sowing, two kg of pulse wonder, biofertilizers (*Pseudomonas, Tichoderma viride*).

This, variety gave the average potential yield of 7.9 q/ha in district. After the improved treatment with Imidacholoprid 6 ml /kg of seed and blackgram sowing by mechanized sowing method. The famer's fields were regularly monitored by the scientists for applications of suitable technologies. Local variety of blackgram was conventionally sown by broadcasting method. The crop was sown after rice harvest during the last week of February and first week of March.

Table 2: Details of yield of FLDs conducted of blackgram summer (2015-16 to 2019-2020).

Year	Area (ha)	No. of farmers	Seed yield (q/ha)			% increase over control	B:C ratio	
			Potential	Demonstration (Average yield)	Control (Average yield)	Demonstration (Average yield)	Demonstration (Average yield)	Control (Average yield)
2015-16	10	10	7.9	13.05	6.85	102	4.94	2.19
	10	20	7.9	9.90	6.11	79.8	3.14	1.95
2016-17	10	19	7.9	8.53	5.3	61.09	2.06	1.24
	5	10	7.9	8.67	4.9	77.68	2.18	1.15
	5	10	7.9	8.45	4.7	79.78	2.26	1.17
	10	25	7.9	8.37	4.5	86	2.56	1.25
2017-18	20	40	7.9	9.81	5.42	87.61	2.10	1.06
2018-19	20	40	7.9	9.87	5.4	88.89	2.11	1.08
2019-2020	20	40	7.9	9.12	5.48	88.64	2.11	1.06

The results of the demonstrations, 15.2 per cent higher yield was recorded than the local check 6.7 q/ha.

The results of the demonstrations, an average yield was higher than check variety. The average yield during the year 2015-16 was 11.47 q/ha and 8.50 q/ha for the year 2016-17. The cost-benefit ratio for the year 2015 -16 was 4.04 and 2016-17 was 2.27 for demonstration (Table 2).

The similar results obtained for Rupesh *et al.* 2017, Conventional varieties 2.07 and 1.20 for the year 2015-16 and 2016-17, respectively. The data indicated that the positive effect of cluster front line demonstration over the existing practices towards increasing the yield of blackgram in Trichirapalli district of Tamil Nadu state. Cost: benefit ratio was recorded to be higher under demonstration than the control during all the year. An average percentage increase over control is 81.05 %. During the period of study emphasis the need to educate the farmers through various techniques for adoption of improved agricultural production reverse the trend of wide extension gap (Tiwari and Saxena, 2001).

Different physiological parameters were observed in the samples collected from different farmer's field. The results from the demonstration revealed that, the demo samples registered a higher germination percentage than check variety. The average germination percentage of demo sample is 79.69% with a 12% increase over the check variety (67.17%) (Table 2).

Increase over check variety was found in plant height. The average plant height of demo samples was 44.79 cm whereas the check variety has 35.72 cm (Table 3). Similar increase in plant height were found in lettuce using *Pseudomonas* biofertilizer (Rostaminia *et al*., 2020; Santana-Fernández *et al*., 2021), spraying with Pulse wonder increased plant height in black gram (Kamaleshwaran and Karthiga, 2021). And the number of pods per plant was higher in demo (50.93) than check variety (41.07) (Table 3)

Table 3: Observation on growth attributes during FLD.

Sample	Germination (%)		Plant height (cm)		No of pods per plant		Pod length (cm)		Pod filling (%)		B:C ratio	
	Check	Demo	Check	Demo	Check	Demo	Check	Demo	Check	Demo	Check	Demo
Sample 1	72 (58.05)	78 (49.63)	36	49	42	47	5.2	5.5	66 (67.21)	85 (67.21	2.18	1.26
Sample 2	74 (59.34)	82 (50.38)	34	47	45	68	5.1	5.7	71 (63.43)	80 (63.44	2.00	1.26
Sample 3	71 (57.42)	84 (49.27)	42	38	37	56	4.8	5.2	68 (65.65)	83 (65.6)	2.18	1.26
Sample 4	68 (55.55)	83 (48.19)	39	39	41	56	4.5	4.8	60 (50.77)	75 (60)	2.15	1.26
Sample 5	66 (51.35)	85 (45.78)	33	38	45	54	3.9	4.9	66 (54.33)	76 (60.67)	2.02	1.26
Sample 6	68 (53.13)	79 (46.79)	35	37	47	53	4.2	4.5	66 (54.33)	83 (65.65)	2.01	1.26
Sample 7	61 (52.54)	77 (46.45)	34	42	49	56	4.4	4.8	71 (57.42)	71 (57.42)	2.25	1.26
Sample 8	64 (58.05)	76 (49.63)	34	39	52	58	4.9	4.6	60 (50.77)	83 (65.65)	2.00	1.26
Sample 9	63 (59.34)	74 (50.38)	36	48	41	51	5.1	5.6	71(57.42)	78(62.03)	2.18	1.26
Sample 10	72 (60.00)	78 (50.77)	34	47	45	56	4.6	5.8	68 (55.55)	81 (64.16)	2.15	1.26
Sample 11	74 (56.17)	81 (48.54)	39	45	48	49	4.5	5.8	65 (53.73)	83 (65.65)	2.15	1.26
Sample 12	75 (53.13)	83 (46.79)	34	45	47	48	4.6	5.4	67 (54.94)	76 (60.67)	2.14	1.26
Sample 13	69 (55.55)	78 (48.19)	36	48	46	52	4.9	5.6	65 (53.73)	74 (59.34)	1.97	1.26
Sample 14	64 (51.94)	82 (46.11)	38	42	42	46	4.7	5.2	70 (56.79)	78 (62.03)	2.09	1.26
Sample 15	68 (57.42)	80 (49.27)	37	38	43	43	4.8	5.8	68 (55.55)	79 (62.73)	2.13	1.26
Sample 16	62 (53.73)	79 (47.14)	39	49	46	49	4.2	5.4	65 (53.73)	81 (64.16)	2.10	1.11
Sample 17	71 (53.13)	82 (46.79)	35	52	42	52	4.8	5.7	64 (53.13)	79 (62.73)	2.08	1.1
Sample 18	65 (54.33)	83 (47.48)	34	46	35	54	4.5	5.8	67 (54.94)	83 (65.65)	2.18	1.11
Sample 19	64 (57.42)	88 (49.27)	36	48	34	57	4.2	5.5	72 (58.05)	83 (65.65)	2.25	1.11
Sample 20	66 (58.69)	81 (50.01)	34	46	37	49	4.8	5.6	68 (55.55)	83 (65.65)	2.18	1.11
Sample 21	71 (53.73)	82 (47.14)	35	51	39	46	4.9	5.7	64 (53.13)	83 (65.65)	2.18	1.11
Sample 22	73 (52.54)	78 (46.45)	36	49	41	48	4.5	5.8	63 (52.54)	83 (65.65)	2.08	1.11
Sample 23	65 (54.33)	79 (62.73)	31	46	34	44	4.1	5.7	64 (53.13)	80 (63.45)	2.10	1.11
Sample 24	63 (52.54)	76 (60.67)	36	47	36	49	4.3	5.6	65 (53.73)	80 (63.45)	2.18	1.11
Sample 25	64 (57.42)	77 (46.45)	38	46	35	48	4.1	5.4	66 (67.21)	80 (63.45)	2.12	1.11
Sample 26	66 (58.69)	75 (60)	34	51	34	46	4.2	5.4	60 (50.77)	80 (63.45)	2.15	1.11
Sample 27	66 (58.69)	76 (60.67)	36	45	36	51	4.1	5.6	64 (53.13)	80 (63.45)	1.95	1.11
Sample 28	62 (53.73)	74 (50.38)	35	39	38	47	4.3	5.7	62 (51.95)	80 (63.44)	2.01	1.11
Sample 29	61 (51.35)	81 (50.01)	36	42	34	44	4.1	5.6	64 (53.13)	81 (64.16)	1.93	1.11
Mean	67.17 (55.04)	79.69 (61.13)	35.72	44.79	41.07	50.93	4.53	5.44	65.86 (54.2)	80.03 (63.46)	2.11	1.19
SEd	1.21	1.24	0.63	0.52	0.65	0.70	0.07	0.08	1.14	1.12	0.04	0.01
CD (P=0.05)	2.43	2.48	1.26	1.03	1.30	1.40	0.15	0.16	2.28	2.25	0.08	0.02

(Figures in parenthesis indicate arcsine transformed values).

which can directly influence the seed yield. Similar results were registered in pod filling percentage and pod length with increase over of 14.17% and 0.91 cm, respectively. Similar results was identified in black gram by foliar application of pulses wonder @ 5 kg/ha flowering and 15 days after 1st DAS spray of crop growth resulted in significantly increased plant height, higher number of pods / plant, seeds/pod, grain yield (kg/ha straw yield (kg/lr), harvest index (%) net return (Rs), benefit cost ratio than other foliar spray treatments. (Devaraju and Senthivel, 2018).

Molla *et al.* (2012) demonstrated that increase in plant height, number of fruit per plant, individual fruit size and enhanced yield in tomato by application *Trichoderma viride* biofertilizer. Similar results were reported in wheat (Mohato *et al*., 2018). Application of 100% recommended dose of NPK + DAP 2% + TNAU pulse wonder 5.0 kg ha^{-1} was statistically significant and recorded higher plant growth, number of pods / plant, yield of black gram and benefit cost ratio over the control (Marimuthu and Surendran, 2015).

Sujatha and Ambika (2016) reported that the designer seeds (treatment consisted of seeds fortified with KCl 1% for 6 h followed by polymer coating @ 3 ml/ kg + Carbendazim @ 2 g/kg + imidachloprid @ 2 ml/kg + *Trichoderma viride* @ 4 g/kg + *Azospirilum lipoferum* @ 40 g/kg enhanced the plant growth and yield with increased pods/plant, pod yield/plot (g) and seed yield/ plant (g), earlier days to 50% flowering and pest and disease incidence. Similar results were found in paddy (Sujatha and Ambika, 2018) and cotton (Sujatha and Ambika, 2020).

These increases in plant growth and yield might be due to the higher supply of all nutrients at flower initiation and pod formation stages of crop growth might have caused efficient translocation of photosynthates from source to sink by foliar application of nutrient spray *i.e*., pulse wonder (Kamaleshwaran and Karthiga, 2021; Devaraju and Senthivel, 2018). And also the designer seeds provide protection at initial stages of establishment from seed borne pathogen and along with supply of nutrient by biofertilizer by increasing the nutrient use efficiency.

Biofertilizer *Trichoderma* and *Pseudomonas* assist in solublization and sequestration of many plant nutrients such as P, Mn, Fe and Zn and supply to the plants, thereby increasing plant growth (Lal *et al*., 2013). The increased root biomass and accumulation of nitrogen and the plant growth hormone production *viz*., gibberellins and cytokinin will promote the growth of the seedlings by these inoculants. These results had an influence on cost benefit ratio.

CONCLUSION

Cluster frontline demonstrations on pulses (blackgram) conducted in five villages in and result concluded that 2015-16 was 11.47 q/ha and 8.50 q/ha for the year 2016-17. The Cost-benefit ratio for the year 2015 -16 was 4.04 and 2016-17 was 2.27 for demonstration. There was 81.50 per cent increase in yield observed in demonstration plot over farmers' practice. It was observed that potential yield can be achieved by imparting scientific knowledge to the farmers, providing the quality need based inputs and proper application of inputs. Combination of technical inputs *viz*., designer seeds, application of TNAU pulse wonder and biofertilizers with scientific interference have increased the potential yield of a crop.

Conflict of interest: None.

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