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Enhancing in the productivity of blackgram through chemical and bio fortification practice trials in Kalaburagi district of Karnataka

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Abstract
Blackgram (*Vigna mungo* L.) is one of the major rainy season pulse crops also known as urd or mash grown throughout India. One of the major constraints of its low productivity is non-adoption of improved technologies. In this point of view Krishi Vigyan Kendra, Kalaburagi conducted Front line demonstration at 108farmers field to demonstrate production potential and economic benefit of improved technologies comprising improved varieties, integrated nutrient management and timely weed removal, line sowing (30 × 10 cm), and IPM. The seeds were treated with biofertilizers. Pre-emergence application of weedicide Pendimethalin at 2.5 kg a.i /ha used for effective control of the weeds during Kharif season of 2014-15 to 2016-17 in rainfed condition. The improved technology recorded a mean yield of 8.46 q/ha which was 14.18 % higher than that obtained with farmers practice yield of 7.29 q/ha. The improved technologies resulted higher mean net income of Rs.27613 /ha with a benefit cost ratio of 2.83 as compared to local practice (Rs. 22721/ha, 2.55 respectively). There is a need to adopt multipronged strategy that involves enhancing blackgram production through better adoption of improved technology.

Keywords: Blackgram, pulse magic, technology gap, yield and net return

Introduction
Pulses are commonly known as food legumes which are secondary to cereals in production and consumption in India. Pulses are an important source of dietary protein, energy, minerals and vitamins for the mankind. Pulses provide 25 per cent of protein requirements of predominantly vegetarian population. Blackgram (*Vigna mungo* L.) is one of the major rainy season pulse crops also known as urdor mash grown throughout India. It is consumed in the form of "dal". In India, Among the grain legumes, blackgram is an ancient and well known leguminous crop of Asia, is a favorable one since it thrives better in *kharif* season and it can be grown as a sole or inter crop or fallow crop. It is popular because of its nutritional quality having rich protein. Pulses play an important role in Indian Agriculture as they restore soil fertility by fixing atmospheric nitrogen through their nodules. These are drought resistant and prevent soil erosion due to their deep root system and weed suppression.

The yield potential of blackgram is very low because of the fact that, the crop is mainly grown in rainfed conditions with poor management practices and also due to various physiological, biochemical as well as inherent factors associated with crop. Apart from the genetic makeup, the physiological factor viz., insufficient portioning of assimilates, poor pod setting due to the flower abscission and lack of nutrient during critical stages of crop growth play a major role in declined blackgram production was coupled with a number of diseases and pests (Mahala *et al.*, 2001) [4]. The production of pulse crop in our country including blackgram is not sufficient enough to meet the domestic demand of the population. Hence, there is an ample scope for enhancement of the production and productivity of blackgram by proper agronomic practices.

Materials and Methods
Frontline Demonstration is the new concept of field demonstration evolved by ICAR with the inception of technology mission on oilseeds and pulses. The main objective of frontline demonstrations is to demonstrate newly released crop production technologies and its management. practices in the farmer's field. The present investigation was carried out at-adopted villages of KVK, Kalaburagi (Karnataka state).

The materials for the present study comprised high yielding strain of black gram (DU-1). Locally cultivated variety were used as local check. The soil type was medium to low in soil fertility status. The objective of the performance evaluation was to study the gaps between the potential yield and demonstration yield, extension gaps and the technology index. The Frontline demonstrations (108) were organized on farmer's field to demonstrate the impact of integrated crop management technology on blackgram productivity over three years during *Kharif*season2014-15to 2016-17. Each frontline demonstration was laid out on 0.4 ha area, adjacent 0.4 ha was considered as control (farmer's practice). The integrated crop management technology fallowed (Table 1). The yield data were collected from both the demonstration and farmers practices by random crop cutting method. Qualitative data were converted into quantitative form and expressed in terms of per cent increase in yield calculated using following formula (Samui *et al.*, 2000) [7].

Table 1: Improved production technology and Farmers practices of blackgram under FLD

S. No.	Technology	Improved practices	Farmers practice	GAP (%)
1	Variety	DU-1	Local	100
2	Land preparation	Ploughing and harrowing	Ploughing and harrowing	Nill
3	Pre emergent herbicide	Pendimethalin (@ 2.5 l/ha)	No herbicide	Full gap
4	Seed rate	12-15 kg/ha	18-20 kg/ha	Partial gap
5	Sowing method	Line sowing	Line sowing	No gap
6	Seed treatment	Biofertilizers and Trichoderma	No seed treatment	Full gap
7	Fertilizer dose (NPK kg/ha)	25:50:0	10:20:0	Partial gap
8	Plant protection	IPM	Indiscriminate application	Full gap

Technology gap = Potential yield – Demonstration

Yield Extension gap = Demonstration yield – Farmers yield

Technology index = ((Potential yield - Demonstration yield) / Potential yield} X 100

Results & Discussion

During the 2010-11 to 2016-17 of seven years study period it was observed that the adoption of improved production technologies in demonstration trials has increased the yield over the farmers' practices. Full gap was observed in most of production technology was the reason of not achieving potential yield. Farmers were not aware about recommended technologies.

Frontline demonstration was conducted on 44 hectares of land on 108 demonstration plots. The high yielding strain of Blackgram DU-1 was used for study. The growth and yield attributing parameters are increased with improved production technology. On an average the plant height, Number of pods per plant and pod length increase were observed27.2 cm, 28.4 and 4.4cm, respectively compare to farmers practice (20.3cm, 23.1 and 4.1 cm, respectively) during the study period. The result indicates that the growth and yield parameters are increased in demo plots compare to farmers practice due to improved production technology such as improved variety, seed treatment with biofertlizers and early weed control, low seed rate will help for the plants to grow properly. The result indicates that the frontline demonstration has given a good impact over the farming community of Kalaburagi as they were motivated by the new agricultural technologies applied in the FLD plots.

On an average the yield increase observed was 8.46 q/ha in demo fields compare to check 7.29 q/ha which was increase in 14.1 % during the 2010-11 to 2016-17 of seven years study. The result indicates that the frontline demonstration has given a good impact over the farming community of Kalaburagi as they were motivated by the new agricultural technologies applied in the FLD plots. Yield of black gram was, however varied in different years, which might be due to the soil moisture availability & rainfall condition, climatic aberrations, disease and pest attacks as well as the change in the location of trials every year. The DU-1 had performed well when compared to local check. The percentage increase in the yield over local check was 6.25, 00,11.25, 11.8, 10.6, 7.9 and 11.4 during seven subsequent years (2010-11 to 2016-17). The demonstrations in the year 2011-12 were Vitiated due to moisture stress. The increased grain yield with improved technologies was mainly because of line sowing, use of nutrient management and timely weed management.

Fertiliser response has been widely studied in other countries and the extent of the response depends on many factors: with high yielding varieties higher fertiliser rates are needed and also in cases of lower soil fertility (Tripathi and Rajput, 2007) [8]. The reason for this could be the inter plant competition for the moisture and nutrients which could be more severe under local check demonstration (Farmers practice). Also, the higher weed infestation under the local check as evident from the higher weed cover and reduced theamount of nutrients and water available to the local check. This agrees with the findings of Imoloame *et al.* (2007) [2] who reported the superiority of row planting over broad casting to control weed and that this factor resulted in considerable yield increased and also grain yield increased significantly. This may be attributed to sufficient and more than average rainfall distributed fairly during the pod setting to physiological maturity stage, better utilization of applied nutrients (Poonia and Pithia, 2010) [6].

The economic viability of improved technologies over traditional farmer's practices was calculated depending on prevailing prices of inputs and output costs (Table 3). It was found that cost of production, gross return, net return and B:C ratio of blackgram under improved technologies varied from Rs 8200 to 16700 /ha, Rs 22500 to 77520 /ha, Rs 14300 to 60820 /ha and 2.74 to 4.64, respectively with an average of Rs.11586 /ha, Rs.39198 /ha, Rs.27613 /ha and 2.55, respectively as against farmers practice (local check). The additional cost increased in the improved technologies was mainly due to more cost involved in balanced fertilizer, improved seed and weed management practices. Similar results also have been reported by Khan *et al.* (2009) [3]. To get maximum yield of blackgram recommended package of practices should be followed. By not following any one management practice yield may be reduced severely and it was also observed that delay in sowing, unbalanced does of fertilizer, untimely weed management and plant protection drastically reduced the grain yield of blackgram.

Technology gap (Table 4), the gap in the demonstration yield over potential yield ranges from 13.2 to 17.1. The technology gap observed may be attributed to dissimilarity in the soil fertility status and weather conditions as well as the soil moisture availability. The technological gap may be attributed to the dissimilarity in the soil fertility status and weather conditions (Mukharjee, 2003) [5] Hence location specific recommendation appears to be necessary to bridge the gap between the yields of different technologies. The highest extension gap of 2.15 was recorded during 2012-13. This finding is in corroboration with the findings of Hiremath and Nagaraju, 2010 [1]. The highest technology indexwere 75 percent for the year 2010-11 and lowest in 2013-14 with 52.8 percent. This emphasized the need to educate the farmers through various means for more adoption of newly improved agricultural technologies to bridge the wide extension gap. More and more use of new high yielding varieties by the farmers will subsequently change this alarming trend of galloping extension gap. This high extension gap in all these varieties requires urgent attention from planners, scientists, extension personnel and development departments. The lower the value of technology index more is the feasibility of the technology.

Sustainable intensification strategies for Kalaburagi region require improved soil, water and nutrient management innovations. Blackgram cultivation has also ensured sustainable natural resource management objectives. Vulnerability to natural disasters can substantially be reduced through the adoption of blackgram cultivation because of the improvement in productivity, increase in cash income and acquired assets that families can fall back on when disasters occurs. Despite the low soil moisture availability climatic and natural aberrations faced in region, DU-1 had given a very good result in comparison to local check. These technologies may be popularized in this area by the state agriculture departments and extension agencies to mitigate the large extension gap. Mainly small and marginal farmers are associated with the cultivation of arharin the region and the use of new production technologies will substantially increase the income as well as the livelihood of the farming community.

There is a need to adopt multi pronged strategy which involves enhancing blackgram production through horizontal and vertical expansion and productivity improvements through better adoption of improved technology. In the fragile environments and poor farm resource base, blackgram is the best choice for farmers. Cultivation of blackgram also helps in protecting the environment from the risk of high input agriculture.

Table 2: Growth and yield attributing characters of blackgram

Year	No of Demo.	Area (Ha)	Plant height (cm)		No. of pods/plant		Pod length (cm)	
			Demo	Check	Demo	Check	Demo	Check
2010-11	23	9	31.7	22.9	30.9	23.6	4.8	4.2
2011-12	12	5	Vitiated due to moisture stress					
2012-13	12	5	36.4	25.7	37.4	29.7	5.6	5.1
2013-14	12	5	30.6	23.4	35.3	29.2	5.9	5.3
2014-15	12	5	29.3	20.6	34.3	26.7	5.1	4.8
2015-16	12	5	26.8	20.9	25.6	22.4	4.1	3.8
2016-17	25	10	35.5	28.7	35.2	29.8	5.5	5.2
Average	15.4	6.3	27.2	20.3	28.4	23.1	4.4	4.1
Total	108	44	-	-	-	-	-	-

Table 3: Seed yield and economics of blackgram as affected by improved and local practices in farmers fields.

Year	No of Demo.	Area (Ha)	Yield (q/ha)			% increase in yield over farmers practice	Cost of cultivation (Rs/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		B:C	
			Potential yield	Demo yield	Farmers practice		Demo	Check	Demo	Check	Demo	Check	Demo	Check
2010-11	23	9	25	6.3	5.0	25.0	8200	9500	22500	18000	14300	8500	2.74	1.89
2011-12	12	5	25	Vitiated due to moisture stress										
2012-13	12	5	25	11.3	9.1	23.6	12000	11500	35438	28665	23438	17165	2.95	2.49
2013-14	12	5	25	11.8	10.4	13.5	16000	16600	50150	44200	34150	27600	3.13	2.66
2014-15	12	5	25	10.6	9.6	10.4	15300	14400	47700	43200	32400	28800	3.12	3.00
2015-16	12	5	25	7.9	7.4	6.8	12900	10700	41080	38480	28180	27780	3.18	3.60
2016-17	25	10	25	11.4	9.5	20.0	16700	15400	77520	64600	60820	49200	4.64	4.19
Average	15.4	6.3	25.00	8.5	7.3	14.2	11586	11157	39198	33878	27613	22721	2.83	2.55
Total	108	44	-	-	-	-	-	-	-	-	-	-	-	-

Table 4: Performance of Front Line Demonstrations (FLD) of black gram in Kalaburagi (Karnataka)

Year	No of Demo.	Area (Ha)	Yield (q/ha)			% increase in yield over farmers practice	Technological gap (q/ha)	Extension gap (q/ha)	Technological index (%)
			Potential yield	Demo	Farmers practice				
2010-11	23	9	25	6.3	5.0	25.0	18.8	1.25	75.0
2011-12	12	5	25	Vitiated due to moisture stress					
2012-13	12	5	25	11.3	9.1	23.6	13.8	2.15	55.0
2013-14	12	5	25	11.8	10.4	13.5	13.2	1.40	52.8
2014-15	12	5	25	10.6	9.6	10.4	14.4	1.00	57.6
2015-16	12	5	25	7.9	7.4	6.8	17.1	0.50	68.4
2016-17	25	10	25	11.4	9.5	20.0	13.6	1.90	54.4
Average	15.4	6.3	25	8.5	7.3	14.2	12.97	1.17	51.89
Total	108	44	-	-	-	-	-	-	-

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