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Cluster demonstration: Appropriate method of increasing seed production of Rabi crop

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Abstract
Cluster Frontline Demonstration was conducted by Krishi Vigyan Kendra, Patna, Bihar to study the impact of Cluster Frontline Demonstration with different techniques like use of improved cultivar, seed treatment, weed management and insect-pest management on production and productivity of Rabi crop like Linseed, Mustard, Pea, Lentil and Gram. It was observed that variety Shekhar of linseed performed very well as compared to local variety as there was 28.64 % yield gap between both the varieties. In the same manner, mustard variety RNG-48 was found having 31.98 % higher yield in comparison to the local variety. Field pea variety Prakash performed very well as compared to local variety as there was 31.81% yield gap between both the varieties. In the same manner, HUL-57 of Lentil gave 27.08 % higher yield in comparison to the local variety. BG-372 and GNG 1581 variety of Gram showed 27.32 % & 37.63% higher in yield as compared to the local varieties used by farmers of different blocks of Patna district. This study clearly indicates that the use of improved varieties of Linseed, Mustard, Field pea, Lentil and Gram with scientific package and practices can play a major role in improving the quantity of seed production of pulses and may contribute significantly in state and national pulse production programme.

Keywords: Cluster Frontline Demonstration, Improved Cultivar, Seed Production of Pulses, Yield

1. Introduction
Oilseed crops are the second most important determinant of agricultural economy, next only to cereals. India is the largest producer of oilseeds in the world and accounts for about 14 per cent of the global oilseeds area, 7 % of the total vegetable oils production, and 10 % of the total edible oils consumption. In India, oilseeds account for 3% to the Growth National Products and 10% to the total value of all agricultural products. The total oilseed cultivated area, the total oilseed seed production and the total edible oil production, under the nine oilseed crops, were 27 million ha, 29 million matric tones (mmt) and 7.45 mmt respectively. Presently, India's annual edible oil consumption is about 17.5 mmt, which in the last decades has increased steadily at a compounded annual growth rate of 4.6%. The growth in per capita consumption is attributable to both rising income levels and living standards. However, the current per capita consumption of 14.3 kg/year in 2012-13 in India is considerably lower than the global average of 24 kg/year (Kumar, 2014). Indian mustard is the second important oilseed crop in India, next to groundnut [1]. Mustard seed is the second largest produced oilseed in the world with an area of 37.0 m ha, with the production of 63.09 m tonnes and the productivity of 18.50 q/ha. In India it had the area of 6.3 m ha with production of 7.6 m tonnes and productivity of 11.90 q/ha (Bhati and Sharma, 2014, Singh *et al*. 2017a; Singh *et al*. 2017b; Singh *et al*. 2017c; Singh *et al*. 2018; Tiwari *et al*. 2018; Tiwari *et al*. 2019a; Tiwari *et al*. 2019b; Kour *et al*. 2019; Singh *et al*. 2019). Among rabi oilseed crops in India, linseed happens to occupy the second position i.e. next to rapeseed-mustard in area as well as production (Chauhan *et al*., 2009). India ranks first in the world in respect of acreage accounting for 23.8% of the world and third in production contributing 10.2% of the world. In India, it is cultivated on 0.53 m. ha with a production of 0.21 m. tonnes. Its cultivation is mostly confined to Madhya Pradesh, Maharashtra, Chattisgarh, Uttar Pradesh and Bihar (Damodaran and Hegde, 2005).

Now a day, mustard and linseed crop is maintaining its increasing trend in productivity while, the area registered shows a declining trend resulting in its stagnant production. After oilseed crop pulses occupy a unique place in India's nutritional food security as they are a major source of plant protein for vegetarians. India is the biggest producer, as well as the largest consumer and importer of pulses. However, about 14.76 million tones of pulse from an area of 2.23 million ha and 2-3 million tones of pulses are imported annually to meet the country's domestic requirement [14]. 400 improved varities have been released since the inception of all India coordinated pulse improvement programme in 1967 and only 124 varieties are in production chain and only dozen varieties are popular among farmer's. But even with available varieties and technology pulse production can be doubled [4]. Higher productivity could be achieved by disseminating available technological information and skill to farmer through extension worker [8]. The most important way to increase production in short time period is to minimize the yield gap between research station, On farm demonstration and farmers field in pulse [5] Nain *et al*. [9] also identified different constraints in pulse production like input related constraints, know-how related constraints, infra structure related constraints and other constrints and found that non availability of recommended varieties, non availability of recommended biofertilizer, lack of literature in simple language and crop damage by wild animal are the major constraints in enhancing pulse production and productivity.

2. Material and Methods

Cluster Frontline Demonstration was conducted by KVK, Patna (BAU, Bhagalpur, Bihar) during 2016-17on farmer's field at eight blocks namely Barh, Pandarak, Ghoshwari, Sampathchak, Fatuha, Belcchi, Mokama and Danapur, which are traditional producer of pulses and oilseed crop.

In this study, 311 farmers were involved for demonstration of various oilseed and pulses viz. Linseed (Variety-Shekhar), Mustard (Variety-RNG-48), Field pea (Variety-Prakash), lentil (Variety-HUL-57), Gram (Variety-GNG-1581 and BG-372) and in 20 ha, 30 ha, 20 ha, 26 ha and 30 ha area respectively. First of all soil testing of all the 126 ha farms was done in soil science lab of KVK, Patna for pH, EC, Organic carbon, N, P, K, Fe, Cu, Mn and Zn. Then, seed treatment of the entire oilseed crops was done at farmers house in supervision of KVK scientist with Carbendazim@2gm/Kg seed and Chlorpyriphos 20EC@6ml/Kg seed. Based on the soil test value, fertilizers were applied as $N:P_2O_5:K_2O$::50:37.5:20 in linseed and 80:50:40:10 in mustard crop. N was applied in two split half as basal and remaining half after 35 days of sowing after irrigation. Suitable plant protection measures were applied in problematic field to protect the crop from white rust in mustard. No disease was observed in linseed crop. Only pod borer was reported to be a serious problem in Sampatchak block for which Profenophos @ 2 ml/lit water was recommended to spray.

In case of pulses were done with carbendazim, chlorpyriphos and rhizobium culture. Sulphur application was done at the rate of 10 kg/ ha along with other recommended fertilizers before sowing. For managing weed flora, pre-emergence application of pendimethylene at the rate of 1 kg a.i. per ha was done. After 25 days of sowing, one manual weeding was done. To prevent fungal diseases in lentil, one spray of carbendazim + Mancozeb (saaf) @ 2g/l of water and another spray of propiconazole (Tilt) @ 1.5ml/l was done at 45 and 75 days interval respectively after sowing. For Gram, pheromone trap @ 10unit/ha was used for managing pod borer attack after 60 days of sowing and propenophos @2ml/l sprayed in field when pod borer infestation was observed. In case of Field pea, for managing powdery mildew, sulfex @ 3g/l was sprayed twice at 15 days interval. The data was compiled after harvesting of these oilseeds and pulses along with local varieties.

3. Result and Discussion

From above study it was observed that soil samples of all the plots were deficient in zinc and sulphur. So, recommended dose of Zn and S along with other fertilizers were applied in the entire demonstration field of Linseed and Mustard and Zn and P along with other fertilizers were applied in the entire demonstration field of Field pea, Lentil and Gram. Linseed (Shekhar) was given to 50 farmers of Barh and Pandarak blocks for sowing in 20ha area (Table 1). It was observed that the productivity of linseed in demonstration plots in Barh and Pandarak block ranged from 8.14 q/ha and 7.75 q/ha respectively (Table 1), where as in check plots where farmer's local variety was grown, the yield range from 6.36 q/ha to 6.23 q/ha. The average yield of 50 demonstration plots of linseed was 7.95 q/ha which is 28.64 % higher than that of local check. It was observed that the % increase in yield of demo plot ranged from 28.69 % in Barh block to 28.58 % in Pandarak block.

In case of mustard, the yield of demonstrated plots where improved cultivar i.e. RNG-48 was introduced, it was observed to be maximum (10.17 q/ha) at Ghoshwari block and minimum (8.85 q/ha) at Barh block. The yield of farmer's local variety ranged from 6.90 q/ha to 7.94 q/ha, the lowest productivity found in Sampathchak block and higest productivity found in Ghoshwari block. The percentage increase in yield in demo plot over the check plot ranged from 25.60 % in Pandarak to 44.93 % in Sampathchak block. The average yield of 71 demonstration plots of mustard was observed to be 10.17 q/ha which was 29.26 % higher than the local check where only plant protection measure was followed (Table 1).

The linseed and mustard crop yield varies from place to place depending on the climate, soil and technology. The linseed crop yields obtained under CFLDs with improved technology varied from 7.75 to 8.14 q/ha and 6.23 to 6.36 q/ha in check plot.

The mustard crop yields obtained under cluster frontline demonstration with improved technology varied from 8.85 to 10.17 q/ha and 6.90 to 7.94 q/ha in check plot. Bhati and Sharma [10] also supported that mustard yield varies from 11.28 to 15.56 q/ha under effective management of mustard.

Field pea (Prakash) was given to 50 farmers of Barh, Pandarak, Sampathchak, Fatuha, Mokama and Danapur blocks for sowing in 20ha area (Table 1). It was observed that the productivity of Field pea in demonstration plots in different blocks ranged from 9.90 q/ha at Danapur block to 12.86 q/ha at Fatuha block (Table 2), where as in check plots where farmer's local variety was grown, the yield range from 7.82 q/ha to 9.36 q/ha. The average yield of 50 demonstration plots of field pea was 11.23 q/ha which is 31.81 % higher than that of local check. It was observed that the % increase in yield of demo plot ranged from 24.9 % in Barh block to 40.54 % in Sampathchak block. Benefit cost ratio of Field Pea in demonstration plots was 1.95 as compared to 1.44 in local check plot.

In case of Lentil, the yield of demonstrated plots where

improved cultivar i.e. HUL-57 was introduced, it was observed to be maximum (9.58 q/ha) at Pandarak block and minimum (6.97 q/ha) at Fatuha block. The yield of farmer's local variety ranged from 5.62 q/ha to 7.53 q/ha, the lowest productivity found in Fatuha block and the highest in Pandark block. The percentage increase in yield in demo plot over the check plot ranged from 24.68 % in Fatuha to 30.29 % in Mokama block. The average yield of 65 demonstration plots of Lentil was observed to be 8.29 q/ha which was 27.08 % higher than the local check where only plant protection measure was followed. Benefit cost ratio of lentil was 2.55 in demo plot where as in check plot, it was 1.93. Singh *et al*. [9] in his extensive study reported that opportunities for increasing pulse productivity exist in the form of new variety and better crop management practices.

In Gram two cultivar were used namely BG-372 and GNG-1581 which was sown on 30 ha area of 75 farmer's field with full scientific package. It was observed that the production of BG-372 was highest (11.35 q/ha) at Fatuha and lowest (8.78 q/ha) at Sampathchak block compared to local check giving highest yield 9.58 q/ha at Fatuha and that of lowest (6.94 q/ha) at Pandarak block. The average yield of 41 demonstration plot of Gram (BG-372) was 27.32 % more than that of the local check varieties yield and that of 34 demonstration plots where GNG-1581 was sown was observed to give 37.67 % higher yield over check plots. Similar observation was reported by Narayan and Kumar [14] who found that yield gap in Gram is in the tune of 98-100% due to manure, 41-63% due to nitrogen and 30-76% due to phosphorus and 12-22% due to quality seed in Maharashtra.

There is a vast gap between the check yield and yield of demonstrated variety through Frontline Demonstrations on farmers' field. Vittal *et al*. [3] also supported that Frontline Demonstrations is better than farmer practices. The present findings are also in accordance with the findings of Sharma [11] who found that the yield levels under farmers' practices were always lower than obtained under frontline demonstration. According to [7] reported that lack of knowledge, availability of seed, lack of technical knowledge regarding improved pulse cultivation are some of the important constraints in oilseed and pulse production. Thus, the result of these Cluster Frontline Demonstration of various oilseed and pulses have been very encouraging in showing production potential of various technologies in various field condition across Patna district. From the above observation it may be concluded that if farmers use improved varieties of Linseed, Mustard, Field pea, Lentil and Gram along with scientific package and practices, productivity of these crops can be enhanced and can contribute significantly in state and national oilseed and pulse production programme. Thus large scale frontline demonstration could be able to minimize the yield gap and may easily push the country for more oilseed and pulse productivity. Keeping this in view, programme of cluster frontline demonstration should be popularized for other oilseed and pulse crops also in order to increase farmer's income and attain self-sufficiency in oilseeds and pulses production.

Table 1: Area covered for different oilseed and pulses in different blocks under Cluster Frontline Demonstration in Patna district

Name of the Block	Name of the technology demonstrated	No. of the farmer						Area (ha)					
		L	M	P	Le	G1	G2	L	M	P	Le	G1	G2
Barh	Improved cultivars, Fertilizer application, weed management and Seed treatment	41	36	15	20	15	13	16.4	15.2	6.0	8.0	6.0	5.2
Pandark		09	03	15	24	5	17	3.6	1.2	6.0	9.6	2.0	6.8
Ghoshwari		00	06	00	05	00	04	0.0	2.6	0.0	2.0	0.0	1.6
Fatuha		00	04	05	06	04	00	0.0	1.6	2.0	6.0	1.6	0.0
Sampathchak		00	01	04	04	06	00	0.0	0.4	1.6	4.0	2.4	0.0
Mokama		00	21	06	06	07	00	0.0	9.0	2.4	6.0	2.8	0.0
Belchi		00	00	00	00	04	00	0.0	0.0	0.0	0.0	1.6	0.0
Danapur		00	00	05	00	00	00	0.0	0.0	2.0	0.0	0.0	0.0
Average		50	71	50	65	41	34	20	30	20	26	16.4	13.6

L= Linseed (Shekhar), M= Mustard (RNG-48), P= Field Pea (Prakash), Le= Lentil (HUL-57), G1= Gram (BG-372), G2= Gram (GNG-1581)

Table 2: Yield of different oilseed and pulses in different block under cluster frontline demonstration programme in Patna district

Name of the Block	Name of the technology demonstrated	No. of the farmer						Yield(q/ha) Demonstration						Yield(q/ha) Local check						% increase in yield over check					
		L	M	P	Le	G 1	G 2	L	M	P	Le	G 1	G 2	L	M	P	Le	G 1	G 2	L	M	P	Le	G 1	G 2
Barh	Improved cultivars, Fertilizer application, weed management and Seed treatment	41	36	15	20	15	13	8.14	8.85	10.65	8.59	9.69	10.02	6.36	7.05	8.53	6.93	7.63	7.59	28.69	26.50	24.90	24.92	27.49	33.57
Pandark		09	03	15	24	5	17	7.75	9.10	10.88	9.58	9.18	9.67	6.23	7.27	8.37	7.53	6.94	7.04	28.58	25.60	30.64	27.93	32.05	40.14
Ghoshwari		00	06	00	05	00	04	0	10.17	0	9.22	0	10.20	0	7.94	0	7.36	0	7.38	0	29.26	0	25.98	0	39.31
Fatuha		00	04	05	06	04	00	00	10.13	12.86	6.97	11.35	0	0	7.65	9.36	5.62	9.58	0	0	31.70	38.21	24.68	19.66	0
Sampathchak		00	01	04	04	06	00	00	10.0	11.48	7.80	8.78	0	0	6.9	8.18	6.10	7.37	0	0	44.93	40.54	28.65	20.78	0
Mokama		00	21	06	06	07	00	00	10.07	11.62	7.60	10.19	0	0	7.53	8.98	5.83	7.47	0	0	33.90	29.15	30.29	36.43	0
Belchi		00	00	00	00	04	00	00	0	0	0	9.85	0	0	0	0	0	7.78	0	0	0	0	0	27.49	0
Danapur		00	00	05	00	00	00	00	0	9.90	0	0	0	0	0	7.82	0	0	0	0	0	27.42	0	0	0
Average								7.95	9.72	11.23	8.29	9.84	9.96	6.30	7.39	8.54	6.56	7.80	7.34	28.64	31.98	31.81	27.08	27.32	37.67

L= Linseed (Shekhar), M= Mustard (RNG-48), P= Field Pea (Prakash), Le= Lentil (HUL-57), G1= Gram (BG-372), G2= Gram (GNG-1581)

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