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Boosting pulse production under cluster front line demonstrations of Eastern Uttar Pradesh

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Abstract
In India, UP is the second largest producer accounting for about 16 per cent of total production. The area, production and productivity of pulses in UP including district Azamgarh is quite low as compare to other states in respect of national acreage and production. Among various constraints, poor crop management and protection technologies assume primary position. Considering the facts of low yield of pulses due to technological gap and various other constraints, Krishi Vigyan Kendra, Azamgarh of Uttar Pradesh conducted front line demonstration consequently five years on improved agricultural technologies of pulses i.e. pigeon pea, chickpea, field pea and lentil in scientific manner at farmers' field during 2014-15 to 2018-19. A total of 434 demonstrations of pulses were conducted in an area of 215.0 hectares. The results of five years under front line demonstration on pulses revealed that the average grain yield of pigeon pea (20.8 q/ha), chickpea (23.6 q/ha) field pea (25.4 q/ha) and lentil (18.1 q/ha) with their range of 67.7, 60.5, 57.7 and 69.2% increase in yield over farmers practice were recorded under demonstration plots. Implementations of improved technological interventions in all demonstrated crops were also found remunerative in terms of B: C ratio over existing practices. The enhanced yield achieved through adoption of improved production and protection technology in pulses maintain the soil health, incremental sustainable development in production, enhancing nutritional securities and improves the livelihood of the farmers. The outcome of the trial inspired the farming communities to replace their old non-descriptive varieties with resistant and high yielding varieties and other production and protection related technological options which are being cultivated.

Keywords: FLDs on pulses, Grain yield, Food & nutritional security.

Introduction
India is the largest producer, consumer and importer of pulses. Although it is the world's largest pulses producer, there is still a huge shortage of pulses and also, the prices are not affordable to a large section of consumers. An immediate need is the development and dissemination of low-cost technologies in pulses production, so that they can be affordable to the common man. Even though pulses production increased by 3.35% per annum during the last decade, the cost of production and consequent prices are too high to be affordable to the common man; to increase production at lower cost is a bigger challenge. The earlier experience shows that technological efforts need to be supported by the right policy environment to harvest fruits of R&D in agriculture (Reddy 2010) [9]. Still, the productivity of pulses in India is low at 694 kg/ha, and to make pulses production internationally competitive, the average yield levels need to be increased to at least 1.50 ton/ha. Food and nutritional security is an integral component of economic growth and development of the society. Economic upliftment not only implies in income, but also the well being in terms of food and nutritional security of the communities. Majority of farming community in India comes under small and marginal farming, where the size of the land holding is very small to achieve the standards of livelihood. The daily income of these farmers is not sufficient to get their daily needs. Out of the 125 crore Indian populations, 83.3 crore lives in rural areas (Chandramouli, 2011) [2] and their main source of livelihood is agriculture and animal husbandry.

In spite of impressive growth of Indian agriculture, ensuring household food and nutritional security is still challenge due to imbalanced growth in agriculture biased towards wheat and rice. In fact, pulses in India have long been considered as the poor man's only source of protein. Pulses are important in Indian agriculture both in terms of enriching soil health and for food availability and nutritional security of ever growing population and also weaker sections of the society who could not afford other sources of protein. It has been estimated that India's population would reach 1.68 billion by 2030 from the present level of 1.25 billion.

Accordingly, the projected pulse requirement for the year 2030 is 32 million tones with an anticipated required growth rate of 4.2% (IIPR Vision 2030) [5].

Pulses are good sources of proteins and commonly called the poor man's meat. The frequency of pulses consumption is much higher than any other source of protein; about 89.1 percent consume pulses at least once a week, while only 35.4 percent of persons consume fish or chicken/ meat at least once a week in India (IIPS, ORC Macro, 2007) [6]. Further, any reduction in prices of pulses will increase consumption by the poor more than the rich consumers (Mittal 2006) [8]. It can be grown on range of soil and climatic conditions and play important role in crop rotation, mixed and inter-cropping, maintaining soil fertility through biological nitrogen fixation and thus contribute significantly to sustainability of the farming systems (Gowda *et al.,* 2013) [4]. The major pulse producing states are MP (24%), UP (16%), Maharashtra (14 %), AP (10 %) and Karnataka (7 %), Rajasthan (6 %), which together for about 77 per cent of the total production (Reddy *et al.,* 2013) [10]. State productivity of pulses in UP is about 823 kg/ha while, the area, production and productivity of pulses in district Azamgarh of UP are 28012 hectares, 27480 metric tons and 986 kg/ha, respectively (District Sankhyikiya Patrika-2017-18). Any shortfall of pulses production potential has been attributed to a number of factors, the major ones being the increasing population, rising income, inadequate transfer of appropriate technology, seed longevity, poor seed quality, geographical shift, abrupt climatic changes, complex disease, pest syndrome and socioeconomic conditions (Ali and Gupta, 2012) [1]. Adoption of traditional farming system, non adoption of recommended production technologies due to lack of knowledge and conviction about latest proven technologies are also responsible for declining of yield potential of pulse crops. There is need to increase production and productivity of pulses in the country by more intensive technological interventions. Front line demonstration (FLD) is introduction by the ICAR with inception of technology mission of pulse and oilseed crops during mid eighties. The field demonstrations conducted under the close supervision of scientist of the KVK. The basic objectives of demonstration on pulse crops are to demonstrate the superior productivity potentials at the farmers' field under different agro-climatic regions and farming situations. Looking into the importance of diet, increasing soil fertility status and stagnation of production due to biotic, abiotic and other factors, it becomes necessary to bridge the gaps between technological interventions and existing practices.

Keeping the importance of front line demonstration and shortfall of production potential of the pulse crops, the KVK, Azamgarh (UP) has conducted demonstrations on improved production and protection technologies of pulse crops in a scientific manner for establishment of production potential of pulse crops at farmers' fields during the year 2014-15 to 2018-19 with the following objectives.

1. To exhibit the performance of promising high yielding pulses varieties with advanced recommended package of practices for harvesting higher crop yields.
2. To compare the yield levels of local check (farmers' field) and demo fields.
3. To collect feedback information for further improvement in research and extension programme.

Materials and Methods

FLDs on pulse crops were conducted by Krishi Vigyan Kendra, Azamgarh, Uttar Pradesh during the period from 2014-15 to 2018-19 in ten villages *viz.* Sikraur, Dhanehua, Lasara Kala, Sema, Jairampur, Mirza Aadampur, Ekrampur, Khamouli, Sirwa, and Giraur covering 7 blocks out of 22 blocks of district. During these five consecutive years, the demonstrations were conducted as per their respective seasons and a total no. of 146, 108, 96, 84 farmers participated with area of 70.0, 60.0, 45.0, 40.0 ha for the pigeon pea, chickpea, field pea and lentil. The soil of the operational area was generally sandy loam in texture which is low in nitrogen, phosphorous and low to medium in potash. The improved varieties used to grow viz, Narendra Arhar-2, PG 186, Prakash and Narendra Lentil -1 of pigeon pea, chickpea, field pea and lentil, respectively. A balanced dose of fertilizer (DAP @ 125kg/ha) and use of *Trichoderma* @ 10 gm/kg of seed as seed treatment including *rhizobium* and PSB were taken at high priority. While, farmer's practices (use of non-descriptive varieties, broadcasting of seed & fertilizer, no integration of biofertilizers, occasional manual weeding and indiscriminate of plant protection measures etc.) were taken as local check at each site. All the agronomical practices other than the interventions i.e. tillage, seed rate, irrigation, recommended weed management and plant protections measures were applied in similar manner on demonstrated crops. A multi disciplinary scientific team of the centre inspected at regular interval right from sowing to harvesting and made to guide them. These visits also utilized to collect feedback information at location specific for further improvement in research and extension activities that must be matching with farmers needs, stable, feasible and also profitable. The yield data were collected from the demonstrations and control plots and analyzed with the suitable statistical tools to compare the yield of existing practices (local check) and FLDs plots.

Results and Discussion

The pooled data of five years obtained from demonstrations on pulse crops during 2014-15 to 2018-19 are presented in Table 1. Results clearly indicate that the yield of pulses increased successively over the years in demonstration plots. The crop-wise average yield was 20.8, 23.6, 25.4 and 18.1 q/ha in pigeon pea, chickpea, field pea and lentil demonstrated plots while, control plot was recorded 12.4, 14.7, 16.1 and 10.7 q/ha, respectively. The findings are also indicated that the raised crop supplemented with proven production technologies & suggestions at regular intervals enhances grain yield by 67.7, 60.5, 57.7, and 69.2, respectively. The increase in percentage of yield was ranging between 51-67 in pigeon pea, 48-60 in chickpea 36-58 in field pea and 44-69 in lentil during the five years of study. The results clearly speak of the positive effect of front line demonstration over existing practice towards enhanced the yield of pulses in demonstrated area. The similar trends of yield enhancement in front line demonstration of pulse crops has been documented by Yadav, *et al.,* 2007 [11]. The horizontal diffusion of technology in several villages of the district was also noticed with visiting neighbor farmers and scientific visit to farmer's fields. Despite of bitter experience of farmers regarding constraints in pulse production like blue bull, wild animals, Submergence, Insect & diseases etc. are interested to increase pulses area for more profits with least investment of cost & growth resources.

As per economic evaluations like net returns and B: C ratio of front line demonstration clearly revealed that all the pulse

crops recovered the net returns and B: C ratio from the recommended practices was substantially higher than farmers practice during all the years of demonstration. The pulses under improved technological interventions were recorded Rs. 48640, Rs. 47182, and Rs. 42655 and Rs.32788 as average net returns on per hectare in pigeon pea, chickpea, field pea and lentil, respectively. The average benefit cost ratio of demonstrated and control plots were 4.68, 4.50, 3.96, 4.12 and under local check 3.97, 3.51, 3.20 and 3.09 in same sequence of pulses during demonstration period. Hence, favorable benefit cost ratio proved the economic viability of the interventions and convinced the farmers for adoption of intervention imparted. Similar findings were also reported by the Lathwal (2010) [7] during his study in front line evaluations on urdbean at Haryana. Farmers were encouraged to adopt these scientific technologies through organizing field days, training programme and farmers conventions etc. at appropriate at the demonstration sites.

Table 1: Performance of front line demonstration on pulses during 2014-15 to 2018-19 (pooled data)

Crop	Demonstrated Technology	No. of Demo	Area (ha)	Average Yield (q/ha)		Per cent increase in yield over check	Range of per cent increase in yield	Average net returns (Rs/ha)	BCR		Horizontal spread of technology (No. of villages)
				Demo	Local check				Demo	Local check	
Pigeon pea	Bed planting of NA - 2 + Trichoderma @ 10 g/kg seed+ Rhizobium & PSB each @ 20 g/kg seed + Imazethapyr 1.0 kg/ha+ DAP @125 kg/ha + PP	146	70	20.8	12.4	67.7	51-67	48640	4.68	3.97	219
Chickpea	PG 186 + Trichoderma @ 10 g/kg seed + Rhizobium & PSB each @ 20 g/kg seed +DAP @125 kg/ha + Pendimethalin + PP	108	60	23.6	14.7	60.5	48-60	47182	4.50	3.51	166
Field pea	Prakash + Trichoderma @ 10 g/kg seed+ Rhizobium & PSB each @ 20 g/kg seed DAP @125 kg/ha + Pendimethalin 1.0 kg/ha + PP	96	45	25.4	16.1	57.7	36-58	42655	3.96	3.20	158
Lentil	NDL-1 + Trichoderma @ 10 g/kg seed + Rhizobium & PSB each @ 20 g/kg seed DAP @125 kg/ha + Pendimethalin 1.0 kg/ha + PP	84	40	18.1	10.7	69.2	44-69	32788	4.12	3.09	44
Total		434	215								

Demo indicates Demonstration, BCR= Benefit cost ratio & PP= Plant protection measures

Conclusion

Food production provides the base for food security as it is a key determinant of food availability. Importance of pulses in maintaining food security as well as nutritional security and soil ameliorative has been felt since long. Front line demonstration on pulse crops showed a significant increase in yield of demonstration over farmers practice and higher income also. By this way, the livelihood security of the small and marginal farmers can be improved by increasing the productivity of pulse crops. The enhanced yield achieved through adoption of improved production technologies and increased the income of the farmers. Front line demonstration was also effective in changing attitude, skill and knowledge of improved/recommended practices of pulses cultivation including adoption. It was highly appreciated by farmers because of due to most effectiveness, easily compatible in existing cropping system as well as good impact over crop yield parameters. This has cumulatively been able to raise living standard of farmers and overcome the problem of poverty, malnutrition and unemployment.

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