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Pulses for Nutritional Security and Ecological Sustainability

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ABSTRACT

The country is continuing striving for increasing genetic gains through novel technologies, like transgenic technology, incorporating photo-thermal insensitivity and breeding short-duration varieties for increasing cropping intensity, conservation agriculture and strategic practicable technologies, research on storage structures and minimizing post harvest losses, promoting participatory and demand driven research including value addition and appropriate policy support. All these again oriented towards reducing cost of production and enhancing income through scaling productivity so as to double the farm income by 2022.

Keywords: Ecological, Nutritional, Post harvest, Pulses, Sustainable

INTRODUCTION

In realizing self-sufficiency in pulses and Doubling farm income by 2022 A.D., the country has developed a roadmap to realize these national priorities. Following support of all our stakeholders including the farmers and policy backups, India has created a history by a record production of pulses of around 24.0 million tonnes (MT) from around 30 m ha (MH) with a productivity of more than 800 kg/ha during the last 3 years. It may be mentioned here that this incredible success was achieved through synergy in the diverse and strategic components of self-sufficiency that includes the outstanding achievements realized through scaling seed production (through 150 seed hubs and strengthening BSP), use of genomic resources, promotion/adoption of matching technologies, adequate policy support (MSP, market support, financial incentives, pulses buffer stock and good governance), value addition and processing, skill enhancing training and capacity development at diverse stake holders. It is because of these all-round strategies/ success, our pulses production is also showing required stability over the last three years (2016-17 to 2018-19).

METHODOLOGY

The requirements for pulses in the country is projected at 32 MT by 2030 and 39 MT by 2050 at an annual growth rate of 2.2%. This requires strategic steps in research, generating innovations, its dissemination, and commercialization along with capacity building. Projections based on per capita availability of land, population growth rate and technological innovations shows that productivity has to be scaled up by an average of about 80 kg/ha during every 5-year interval to achieve average pulses yield of 950 kg/ha by 2025 and 1335 kg/ ha by 2050 following expanding its acreage by about 4 MH. In pulses, it is also noteworthy to mention that ample number of HYVs of different pulse crops have been released and notified for their cultivation in the country recently. Marker assisted breeding & development and utilization of genomic tools are being given importance to develop multiple disease resistant cultivars for desired stability. Amalgamated with these are matching package of practices (POPs) which could have tremendous role in enhancing productivity and production in the country.

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RESULTS AND DISCUSSION

The constraints in pulses making it a profitable enterprise are many. Since actual productivities of different pulses are considerably low as compared to their potential yield as well as that realized under on-farm demonstrations (Figure 1), ample scope exists at scaling their realized productivity (under farmers' condition). Since pulses are generally grown in poor and marginal lands with minimal inputs and about 85 per cent of the pulses cultivation in the country is rainfed, productivity of pulses *per se* is low. Our farmers still use age-old varieties, grow their home-saved seeds year-after-year and that too through broadcasting instead of line sowing resulting in low plant population and yield. Farmers often don't use herbicides pre-emergence to weed to control the initial weed growth causing substantial yield loss due to these. In addition, decline in cost is not actually possible since farm mechanization is of low priority in pulses cultivation. In addition, studies showed that a few life saving irrigation/supplementary irrigation could do wonder in case rain fails at the critical stages of pulses (pick branching and reproductive stages).

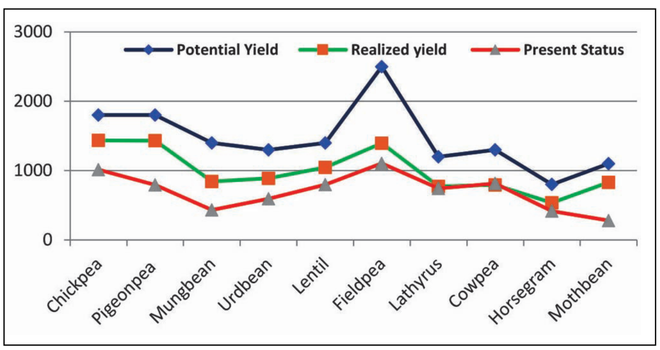

Figure 1: Yield gaps in different pulse crops
Source: IIPR, Pulse (FLDs); Present status as the national average yield

Among pests causing substantial loss in pulses output, gram pod borer in chickpea and pigeonpea, pod fly in pigeonpea, whitefly, jassids and thrips in dry beans cause severe damage to crops. And among diseases, fusarium wilt coupled with root rot complex, sterility mosaic and phytophthora blight in pigeonpea, yellow mosaic, cercospora leaf spot and powdery mildew in mungbean/ urdbean, and the rust and wilt in lentil cause considerable losses. Besides biotic ones, abiotic stresses, like drought and high/low temperature at terminal stage, and soil salinity/alkalinity cause havoc towards potential performance of crops and yield accrual. Socio-economic issues including inadequate VRR/SRR, policy incentives and poor-allocation of storage facilities to pulses again have their toll. All these have significant impact and bearing on scaling productivity in pulses. It has been demonstrated that improved HYVs of pulses have a positive impact to the tune of 15-20 per cent in increasing pulses production in all major pulse crops which can further be accelerated with improved agronomy (POPs) involving these.

Besides vertical expansion involving pulses, there is an ample scope for horizontal expansion of pulses (such as short duration Spring/Summer pulses like, greengram and blackgram in Indo-Gangetic plains and rice fallows of southern India). The geographical shift in pulses towards central and south India (around 4 MH) is an indication of their potentialities to acclimatize to diverse climatic conditions and enabling these to adapt in new niches. It is also estimated that about 11.695 m ha in India remains fallow after rice harvest, of which around 82 per cent lies in the Eastern India and the rest falls in 3 southern states *viz*., Tamil Nadu, Karnataka and Andhra Pradesh. These areas again have a vast potential for low input and low water requiring upland pulses such as *lentil*, *chickpea*, *lathyrus*, *mungbean* and *urdbean*. Besides this, large scope exists to grow pulses in inter-row space of wide row crops, like sugarcane, pearl millets, and sorghum that could brought at least 2-3 MH under pulses.

It is emphasized that all these efforts should complement and supplement to policy support which could possibly through linking pulses to welfare schemes (PDS, Mid Day Meal, and Integrated Child Development Services) where pulses could be a part, would address the issues of protein energy malnutrition among the vulnerable population. In this endeavor, the states of Andhra Pradesh, Tamil Nadu, Himachal Pradesh, Punjab and Chhattisgarh have diversified their PDS with pulses as a means to curb the nutritional deficiency among the poor. Besides these, building farmers' Associations, post-harvest processing through small scale pulse efficient milling units particularly at the village level, need based support in storage infrastructure, supporting with noble

Table 2: MSP (INR/100kg) of major Pulses in India during last 3 years (includes bonus)

Crop	2016-17	2017-18	2018-19
Pigeonpea	5050	5450	5675
Mungbean	5225	5575	6975
Urdbean	5000	5400	5600
Chickpea	4000	4400	4620
Lentil	3950	4250	4475

MSP and procurement policies (Table 2), necessary arrangements for scaling up skill development in processing are other key areas needed to be taken care of. Other avenues aimed at special niche segment like, Kabuli type chickpea and French bean offers new opportunities for tapping the untapped potential of these pulses through demand in international markets. Besides these, organic food production and its market in India (to grow at 25-30%) needs fillips. For all these, both knowledge and skill enhancement of farmers are handy for promotion of pulses both nationally and globally.

Generating and Promoting Technologies

During the last 3-5 years, ICAR-Indian Institute of Pulses Research, Kanpur and its AICRPs in association with its partners (SAUs & CG Centres) has pursued all its focus in scaling-up the productivity goals consistently on sustained basis through its multifarious efforts. During the last few years, many promising varieties of pulse crops have been released for cultivation in different parts of the country which include chickpea (IPC 2004-01, IPC 2004-98, IPC 2005-62 & IPC 2006-77), fieldpea (IPFD 10-12, IPFD 11-5, IPFD 12-2 & IPFD 6-3), lentil (IPL 316, IPL 526 & IPL 520), mungbean (IPM 410-3 & IPM 205-7), pigeonpea (IPA 203) and urdbean (IPU 07-3). R & D against diverse and dynamic biotic and abiotic stresses have been further strengthened with increasing crop productivity through protection of the pulse crops. Besides these, inheritance of important traits, such as *Fusarium* wilt resistance, double podding, seed size and earliness in chickpea, resistance to wilt, pod fly, sterility mosaic and *Phytophthora* stem blight in pigeonpea; and photo-thermo-insensitivity, seed colour, MYMV resistance, plant type and functional male sterility in urdbean has also been worked out.

Reinforcing the above efforts by our stake holders, we have also developed 4 land mark varieties of pulses with specific features and unique characteristics *viz.* IPL 220 (high Fe and Zn fortified lentil variety), IPH 09-5 (early duration pigeonpea hybrid), IPM 205-7 (Virat, a Super early mungbean variety), IPFD 10-12 (green seeded fieldpea varieties). Besides these, significant advancement was also made in development of transgenic chickpea and pigeonpea events for insect resistance (IR) trait through genetic engineering technology. This will definitely have long-term impact on the management of pod borer *per se* in pulses.The institute has also developed Diagnostic Kits “LYMVs PCR Diagnostic Kit” for identification of viruses causing yellow mosaic disease and Multiplex-PCR “LYMVs Mplex” for the accurate identification of the viruses causing YMV in pulses.

Sustained efforts are also made on improved Agronomy and Package Technologies through adoption/ popularization. These include BBF/raised bed planting for kharif pulses, precision tillage using laser leveler, drip-fertigation in long duration pigeonpea, sprinkler irrigation in chickpea and lentils, popularization of most remunerative pigeonpea + soybean - lentil in Central India, appropriate lentil-seed priming under rainfed, zero till seed drill for resource poor farmers, improved post emergence herbicides (Imazethapyr and Quizalofop-ethyl at 80-100 g/ha POE at 20-25 days after sowing) for better weed control and supplementary irrigation using microirrigation and pond technology. Besides these, rice fallow technologies (like, unpuddled rice/direct seeded rice followed by foliar nutrition of micronutrients and 2% urea in chickpea, life saving irrigation and appropriate crop management practices such as retention of 30 cm rice stubbles, zero tillage and appropriate rice establishment method) have been refined for pulses.

Since economics is the major consideration for success of any crop husbandry practice, greater emphasis is made towards decreasing cost of cultivation and increasing farm output/income through conservation agriculture, farm mechanization and value addition/ processing (higher dal recovery by IIPR Mini Dal Mill). Now mechanical harvesting of chickpea (like, GBM 2, NBeG 47 and HC 5 with >20 cm ground clearance) is possible. Besides these, new transfer of technology (TOT, MGMG, Farmer FIRST) models are in vogue for rapid dissemination and adoption of suitable agro-technologies. On BSP, a total of >660 quintals of breeder seed was produced in chickpea, pigeonpea, mungbean, urdbean, lentil, fieldpea, rajmash and horsegram fulfilling the seed-indent fully.

CONCLUSION

Technology demonstration and promotion of pulses was made through diversified projects and activities that included Farmers' FIRST, Soil Health Cards (SHC), promotion of pulses in NEH Region, Seed Production, registering farmers under e portal '*Dalhan Sandesh*' and voice based SMS advisory service and conduct of demonstrations, designing Commodity profile for pulses (CPP Portal), registering Copyright for software and filing Trademark of PulsExpert and developing farmers friendly website e-*Dalhan Gyan Manch* and *Chana Mitra* app, and organizing training programmes and exposure visits for farmers. The country is continuing striving for increasing genetic gains through novel technologies, like transgenic technology, incorporating photo-thermal insensitivity and breeding short-duration varieties for increasing cropping intensity, conservation agriculture and strategic practicable technologies, research on storage structures and minimizing post harvest losses, promoting participatory and demand driven research including value addition and appropriate policy support.

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