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# Yield Gap Analysis of Major Pulses Grown in Punjab

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**ABSTRACT**

*Introduction:* India is the largest producer, consumer and importer of pulses. Still there is a shortage of pulses and the prices are unaffordable to customers.

*Context:* Stagnant productivity combined with low availability has made significant demand supply gaps, affecting nutritional security of Indian population for whom pulses are one of the *cheap sources of protein.*

*Objective:* To assess the performance of major pulse crops grown in Punjab state in terms of grain yield, extension gap and technological gap by the farmers

*Methods:* A total of 160 respondents were selected randomly from four major pulses producing districts of Punjab. The methodology developed by IRRI was used to study the yield gaps. This total yield gap comprised of yield gap-I and yield gap-II.

*Results & Discussion:* The overall results of yield gaps found that technological gaps (gap-I) were observed more than extension gap (gap-II). The technology index showed that gram variety PBG 7 (32.06 %) is best suitable among all other varieties of major pulse crops which are followed by summer moong variety SML 668 (32.93%). Whereas in extension gap summer moong variety SML 668 (21.82%) is best suitable among all varieties of major pulse crops.

*Significance:* The finding will be useful to the programme developers and policy makers to design and develop strategies for better implementation of extension programme for enhancing the production and productivity of pulses and reducing the yield gap at farmers' field.

Globally, India holds the top position as the largest producer, consumer, and importer of pulses. In 2014–15, India produced 17.4 million tonnes of pulses and consumed 22.7 million tonnes, with imports amounting to 4.6 million tonnes (Umanath *et. al.,* 2016). Still there is a shortage of pulses and the prices are unaffordable to customers. Pulse productivity in 1950 was 441 kg/ha. During 2011, it is increased up to 689 kg/ha, enrolling 0.56 per cent growth rate per annum. There was 14.66 million tons of production in 2008-09 with 655 kg/ha of an average yield. The total pulse produced in 2013-14 was recorded as 19.50 metric ton (Singh *et. al*., 2013). Stagnant productivity combined with low availability has made significant demand supply gaps, affecting nutritional security of Indian population for whom pulses are one of the cheap sources of protein (Satyasai and Mohanty 2010).

With this background, the current study was undertaken with the particular objectives to assess the performance of major pulse crops grown in Punjab state in terms of grain yield, extension gap and technological gap by the farmers so that the findings of the study will be helpful to the concerned policy makers and other stakeholders to focus on the way forward for improving pulses production in the region, vertically and horizontally as well.

## METHODOLOGY

Purposive sampling method has been utilised where Ludhiana, Gurdaspur, Tarn Sahib and Ferozepur were chosen based on potential gap matrix from Punjab state (latitudes 29.30° North to 32.32° North and longitudes 73.55° East to 76.50° East.). Further one block from each district was chosen randomly and two villages from each selected block were also chosen randomly. Therefore, a sum of eight villages was selected for the present study. At last, 20 respondents who were growing at least two major pulses were chosen randomly from eight selected villages. Therefore, an aggregate of 160 respondents were selected to represent sample of the study.

*Yield gap* : It is operationalized as per the variance among potential yield and actual yield obtained. It comprises of 2 components yield gap I and yield gap II.

*Yield gap I (Technology gap)* : It was calculated on the basis of potential yield of a particular variety of particular region of selected pulse crops. It was the gap between potential yield (PY) of a variety and demonstration yield (DY) at the research station. The estimation of technology gap and extension gap was done using formulae given by Kadian *et. al*., (1997) and Samui *et. al*., (2000) as under:

$$\text{(Yield gap I (\%)} = \frac{A}{B} \times 100$$

*Yield gap II (Extension Gap) :* It was the variance among the demonstration yield and farmers' yield at farmer's field that is:-

$$\text{Yield gap II (\%)} = \frac{B - C}{B} \times 100$$

Where,

A= Potential Yield; B= Demo. Yield; C= Farmers' Yield

The yield gaps for prominent varieties of pulse crops cultivated in the state of Punjab were determined by obtaining data from the pulse section of plant breeding at Punjab Agricultural University, Ludhiana, regarding potential yields of different pulse crops grown in Punjab state, KVK's of respective districts and published sources regarding demonstration yields of different CFLD conducted by respective KVK of study area. The data was collected from the respondents of four selected districts of Punjab to analyze the yield gap in summer moong, summer mash, gram and lentil during the year 2021.

**Location of study area of Punjab State**

## RESULTS

*Analysis of yield gaps in major pulses in four selected districts of Punjab* : In the findings of yield gaps in Tarn Taran Sahib district (Table 1), it was observed that technological gaps (gap-I) were more prominent than extension gaps (gap-II) in both summer moong and summer mash varieties. The technology index for summer moong varieties indicated that variety SML-668 (T.I. 40.98%) was more viable compared to variety SML-832 (T.I. 48.63%) in the Tarn Taran Sahib district.

It has also been observed that summer moong variety (SML-832) had more extension gap (gap-II) i.e. 22.57 per cent than variety (SML-668) i.e. (17.35%). Similarly, technological gaps (gap-I) in summer mash were observed to be more than extension gap (gap-II). The comprehensive analysis of yield gaps in pulses within Tarn Taran Sahib district revealed that technological gaps (gap-I) were more prominent than extension gaps (gap-II) across varieties of both summer moong and summer mash crops.

The findings from the analysis of yield gaps in major pulses in Ludhiana district (Table 1) indicated that technological gaps (gap-I) were more pronounced than extension gaps (gap-II) in both varieties. The technology index of the summer moong showed that variety SML 668 (T.I. 29.27 %) found more suitable than SML 832 (T.I. 31.81 %).

Likewise, the extension gap for the summer moong variety SML 668 was computed at 27.59%, indicating its greater feasibility compared to variety SML 832 (33.33%). The comprehensive analysis of yield gaps in pulses in Ludhiana district revealed that technological gaps (gap-I) were less prominent than extension gaps (gap-II) in the varieties of summer moong crop.

The findings from the yield gap analysis in Ferozepur district (Table 1) revealed that technological gaps (gap-I) were more prominent than extension gaps (gap-II) across the varieties of both crops. The technology index for summer moong varieties indicated that variety SML-668 (T.I. 31.70%) was more viable compared to variety SML-832 (T.I. 42.04%) in the Ferozepur district.

The summer moong variety (SML-832) was also observed more extension gap (21.56 %) than variety (SML-668) i.e. (19.64 %). Likewise, in the case of gram, technological gaps (gap-I) were more noticeable than extension gaps (gap-II). The comprehensive analysis of yield gaps in pulses in Ferozepur district revealed that technological gaps (gap-I) were more prevalent than extension gaps (gap-II) across varieties of the pulse crop.

The findings from the yield gap analysis in Gurdaspur district (Table 1) indicated that technological gaps (gap-I) were more prevalent than extension gaps (gap-II) across the varieties of major pulses. The technology index revealed that the gram variety PBG 7 (T.I. 35.54%) was more feasible compared to the summer mash variety Mash 1008 (T.I. 44.98%) and the lentil variety LL 931 (48.11%) in Gurdaspur district. Whereas in extension gap summer mash variety Mash 1008 (17.39%) is more feasible than gram PBG 7 (18.92%) and lentil LL 931 (27.08%) variety.

The overall yield gap analysis in pulses in district Gurdaspur found that technology gaps (gap-I) were observed more than extension gap (gap-II) in varieties of the major pulse crops.

*Overall Analysis of yield gaps in major pulses in four selected districts of Punjab :* It has been observed that the 50 demonstrations on different pulses (summer moong, summer mash, gram and lentil) were conducted per district by five Krishi Vigyan Kendra of selected districts. The overall findings of yield gaps in Punjab state (Table 2) revealed that technological gaps (gap-I) were more significant than extension gaps (gap-II) across varieties of all crops. The technology index indicated that the gram variety PBG 7 (32.06%) is the most suitable among all other varieties of major pulse crops, followed by the summer moong variety

**Table 1. Yield gap analysis in major pulses in different districts of Punjab**

| Crop | Yield obtained quintal/ha | | | Yield gap I (%) | Yield gap II (%) |
|---|---|---|---|---|---|
| | Potential yield (A) | Demonstration yield (B) | Farmers yield (C) | | |
| *Tarn Taran Sahib* | | | | | |
| Summer Moong SML-668) | 20.50 | 12.10 | 10.00 | 40.98 | 17.35 |
| Summer Moong (SML-832) | 22.00 | 11.30 | 8.75 | 48.63 | 22.57 |
| Summer Mash (Mash-1008) | 20.90 | 11.80 | 8.00 | 43.54 | 32.20 |
| *Ludhiana district* | | | | | |
| Summer Moong (SML 668) | 8.20 | 5.8 | 4.2 | 29.27 | 27.59 |
| Summer Moong (SML 832) | 8.80 | 6.0 | 4.0 | 31.81 | 33.33 |
| *Ferozepur district* | | | | | |
| Summer Moong (SML-668) | 20.50 | 14.00 | 11.25 | 31.70 | 19.64 |
| Summer Moong (SML-832) | 22.00 | 12.75 | 10.00 | 42.04 | 21.57 |
| Gram (PBG 7) | 28.70 | 19.83 | 15.00 | 28.57 | 26.82 |
| *Gurdaspur district* | | | | | |
| Gram (PBG 7) | 28.70 | 18.50 | 15.00 | 35.54 | 18.92 |
| Lentil (LL 931) | 23.13 | 12.00 | 8.75 | 48.11 | 27.08 |
| Summer Mash (Mash-1008) | 20.90 | 11.50 | 9.50 | 44.98 | 17.39 |

**Table 2. Overall yield gap analysis in major pulses in selected districts of Punjab**

| Crop | Yield obtained quintal/ha | | | Yield gap I (%) | Yield gap II (%) |
|---|---|---|---|---|---|
| | Potential yield (A) | Demonstration yield (B) | Farmer yield (C) | | |
| Summer Moong (SML-668) | 20.50 | 13.75 | 10.75 | 32.93 | 21.82 |
| Summer Moong (SML-832) | 22.00 | 13.00 | 9.75 | 40.91 | 25.00 |
| Summer Mash (Mash-1008) | 20.90 | 12.00 | 8.75 | 42.58 | 27.08 |
| Gram (PBG 7) | 28.70 | 19.50 | 15.00 | 32.06 | 23.08 |
| Lentil (LL 931) | 23.13 | 12.25 | 8.75 | 47.03 | 28.57 |

SML 668 (32.93%), summer moon variety SML 832 (40.91%), summer mash variety Mash 1008 (42.58%), and the least feasible lentil variety LL 931 (47.03%).

In contrast, regarding the extension gap, the summer moong variety SML 668 (21.82%) emerged as the most suitable among all major pulse crop varieties, followed by the gram variety PBG 7 (23.08%), summer moong variety SML 832 (25.00%), summer mash variety Mash 1008 (25.53%), with the least suitable being the lentil variety LL 931 (28.57%). These findings align with the results reported by Burman *et. al*., (2010); Kumbhare *et. al*., (2013), and Dutta (2014). The consistency in these findings suggests the presence of less efficient technology, highlighting the need for the development of location-specific and cost-effective technologies for farmers.

## DISCUSSION

The study results indicated that technological gaps (gap-I) were more prominent than extension gaps (gap-II) among the varieties of selected pulse crops in districts Tarn Taran Sahib, Ferozepur, and Gurdaspur (Balai *et. al*., 2012). However, in Ludhiana district, technological gaps (gap-I) were observed to be less significant than extension gaps (gap-II) among both varieties of summer moong. Frontline demonstrations conducted by Krishi Vigyan Kendra through CFLD in farmers' fields revealed an overall increase in the yield of pulse crops, especially moong and gram. This improvement was attributed to farmers adopting enhanced production technologies, as documented by Gautam *et al.* (2007). This increased yield is a result of CFLD programme of providing high yield varieties of pulse crop, demonstration of nutrient and pest management techniques which is very essential for yield enhancement in pulses. It has been cleared from the results that potential yield was higher than demonstration yield as the yield gap-I (technological gap) in all the selected district of Punjab is higher; this shows the improvement over the technology frontiers, this results are in line with Raghav *et. al.,* 2021; Saravankumar, 2020 and Saravankumar, 2021. So, development of location specific high yielding varieties, seed rate, insect-pest management, adequate quality and timely availability of above inputs and demonstration on farmers' field could be some crucial intervention to reduce yield gap-I (technological gap). The technology index illustrates the feasibility of the variety at the farmer's field. Lower the value of technology index, more is the feasibility of technology. This indicated a gap between technology evolved and technology adopted at farmer's field (Arunachalam, 2011; Kumar *et. al.,* 2014 and Sarma *et. al.*, 2014). Hence, it can be concluded from the study that in front line demonstrations, increased seed yield and higher returns were registered through adoption of improved varieties and technologies as compared to the farmers' practices and thus FLDs played an important role in harvesting higher crop yield and returns.

Similarly, the demonstration yield was higher than farmers yield in all the pulse crops grown in selected districts of Punjab. The yield gap-II is manageable and this is because of difference in adoption of agronomical management practices (Lakshmanan,2007). Hence, institutional and government policy support to farmers is required to check the wild animals damaging crops, providing farm credit in time, organizing farmers field schools on pulses during crop season and some special awareness campaign is also organized for improving production and productivity of pulses to reduce the yield gap-II. So, the available agricultural technology generated in the research station does not serve the very purpose until it is disseminated and adopted by its ultimate

## CONCLUSION

The study concludes that technological gaps (gap-I) in pulses were more than extension gaps (gap-II) in the selected districts, with the exception of Ludhiana district. Furthermore, the findings suggest that front line demonstrations facilitated higher yields and greater economic returns through the adoption of improved varieties and technologies. The CFLDs conducted by Krishi Vigyan Kendras proved to be more effective in comparison to farmers' traditional practices, underscoring the significant role of CFLDs in achieving increased crop yields and returns. It is also very important to the state government to plan strategy for inclusion of pulse in prevailing crop rotation. Training programmes should be organized for farmers and extension personnel on regular basis production and protection technologies on pulses as extension intervention for empowering farmers and extension personnel who will reduce extension gap.

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