Yield gap and constraints in production of major pulses in Madhya Pradesh and Maharashtra

S. Gireesh*, N.V. Kumbhare, M.S. Nain, Pramod Kumar and Bishal Gurung

Division of Agricultural Extension, Indian Agricultural Research Institute, New Delhi-110 012, India. Received: 30-06-2018 Accepted: 23-11-2018 DOI: 10.18805/IJARe.A-5067

ABSTRACT

The present study was conducted at farmers' field in Narsinghpur and Umaria districts of Madhya Pradesh; Wardha and Yavatmal districts in Maharashtra during 2016 to 2017. The results of yield gap analysis from a sample size of 160 farmers revealed that the average yield gap-I (technology gap) for pigeon pea and chickpea was 712 to 817 kg/ha and 755 to 789 kg/ha in Madhya Pradesh and in Maharashtra 500 to 657 kg/ha and 395 to 627 kg/ha. While, the average yield gap-II (extension gap) for pigeon pea was relatively lower i.e. 426 to 448 kg/ha in Madhya Pradesh and 454 to 558 kg/ha in Maharashtra. Whereas, the average yield gap-II for chickpea was relatively lower i.e. 264 to 421 kg/ha in Madhya Pradesh and 427 to 518 kg/ha in Maharashtra. However, the overall yield gap analysis in pulses in both the district of Madhya Pradesh found that technology gaps (gap-I) were observed more than extension gap (gap-II) in varieties of both the crop. In case of both the districts of Maharashtra found that technology gaps (gap-I) were observed less than extension gap (gap-II) in varieties of both the crops except variety Jaki 9218 of chickpea and ICPL 8863 variety of pigeon pea. Therefore, it is summarized that technology gap in pulses (pigeon pea and chickpea) was more than extension gap at farmers field. The potential interventions and various constraints of yield gap in major pulses have been highlighted in this paper.

Key words: Constraints, Extension yield gap, Potential yield gap, Yield gap.

INTRODUCTION

Pulses are known as unique jewels of Indian farming. Pulses continued to be an integral component of sustainable crop-production system, as these crops have ability of biological nitrogen fixation (Reddy 2010). Pulses play an important role to enhance the fertility of soil in terms of yield of subsequent crop to the tune of about 20-40 per cent has been recorded (Joshi, 1998). Pulses are an important and relatively inexpensive source of protein for human and animal nutrition and commonly called the poor man’s meat (Reddy, 2010). Pulses are an integral part of many diets across the globe and they have great potential to improve human health, conserve soil, protect the environment and contribute to global food security, besides serving as an important source of protein for a large portion of the global population (Smita and Satyasai, 2015). Knowing the values of pulses, United Nations declared 2016 as the “International Year of Pulses”. The IYP 2016 aims to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed towards food security and nutrition. Although India is the largest producer of pulses in the world, the nation has not been able to achieve self-sufficiency. The growth rate of area under pulse crops is just 0.04 per cent during the period 1967-68 to 2009, as a result pulses’ share in the total food grain production has reduced from 17 per cent in 1961 to 7 per cent in 2009, and it was because of low productivity and high yield gap.

In India, yield gap is very high as compared to other countries yield in different crops ranging up to 60 per cent (Mondal, 2011). The area under pulses has increased from 19 million hectares in 1950-51 to 25 million hectares in 2013-14, but pulses productivity in India is very low i.e <1 tonne/ha compared to global productivity i.e ≥ 2 tonnes/ha. On the other hand, due to increasing population (>1.28 billion), per capita consumption of pulses has been falling constantly due to stagnant production and productivity. This has been due to the presence of a number of impediments in pulse production in India, such as higher yield gaps, abrupt climatic changes, attack of pests and diseases, lack of quality seeds, low adoption rates, etc. India’s rank in productivity is low, 24th in chickpea, 9th in pigeonpea, 23rd in lentil and 98th in total pulses (Reddy, 2004). By 2050, the domestic requirement would be 26.50 mt, in order to feed the population necessitating stepping up the additional produce at 1.86% annual growth rate (Masood and Gupta, 2012). Closing the gap between demand and supply, pulses would require production to grow at least by 4 per cent per annum (Kumar, 1998). Considering the prevailing scenario of pulses in India, research study on yield gaps in major pulses (chickpea and pigeon pea) was taken to know, the status of

*Corresponding author’s e-mail: gireeagri@gmail.com
yield gap in major pulse crop and factors that contribute to the yield gap to develop suitable extension interventions for the benefit of pulse growers.

**Concept of yield gap:** The concept of yield gaps in crops originated from different constraint studies carried out by International Rice Research Institute (IRRI) during the seventies. The yield gap comprises of two components. The first component i.e. yield gap-I is the difference between experiment/research station yield and the potential farm yield. The second component of yield gap-II is the difference between the potential farm yield and the actual average farm yield. According to Kumbhare et al. (2014) yield gap-I (technology gap) is the potential yield of the variety at research station minus yield obtained under on-farm demonstration of the selected cultivar and yield gap-II (extension gap) is the yield obtained under on-farm demonstration minus yield of local check were computed.

**MATERIALS AND METHODS**

The study was conducted in two selected states namely Madhya Pradesh (Narsinghpur and Umaria districts) and Maharashtra (Wardha and Yavatmal districts). From the identified districts of two states, total of 160 farmers growing the pulses (chickpea and pigeonpea) were selected randomly from eight villages i.e. 20 farmers per village. For estimation of yield gap, two popular varieties of chickpea and pigeonpea were selected randomly from different constraint studies carried out by International Rice Research Institute (IRRI) during the seventies. The yield gap comprises of two components. The first component i.e. yield gap-I is the difference between experiment/research station yield and the potential farm yield. The second component of yield gap-II is the difference between the potential farm yield and the actual average farm yield. According to Kumbhare et al. (2014) yield gap-I (technology gap) is the potential yield of the variety at research station minus yield obtained under on-farm demonstration of the selected cultivar and yield gap-II (extension gap) is the yield obtained under on-farm demonstration minus yield of local check were computed.

**RESULTS AND DISCUSSION**

**Overall yield gap analysis in major pulses:** The overall yield gap analysis in major pulses in Madhya Pradesh is given in Table 1. The overall yield gap analysis in pulses in both the district of Madhya Pradesh found that technology gaps (gap-I) were observed more than extension gap (gap-II) in varieties of both the crop (Table 1). Among chickpea varieties, JG 315 was observed more yield gap (33.9 %) than variety JG 63 i.e. (21.9 %). In chickpea, yield gap-I observed from 755 to 789 kg/ha, whereas yield gap-II was observed from 265 to 422 kg/ha. The technology index of the chickpea varieties found that variety JG 315 (T.I. 37.5%) was more feasible than variety JG 63 (T.I. 39.4%). In pigeon pea, yield gap-I was observed from 712.5 to 817.5 kg/ha, whereas yield gap-II was observed from 265 to 422 kg/ha. The technology index of the chickpea varieties found that variety JG 315 (T.I. 37.5%) was more feasible than variety JG 63 (T.I. 39.4%). In pigeon pea, yield gap-I was observed from 712.5 to 817.5 kg/ha, whereas yield gap-II was observed from 427 to 448 kg/ha. It is also found that from the Table 1 that among pigeon pea varieties, TJT 501 were having more yield gap (36.1 %).

**Table 1:** Overall yield gap analysis in pulses in Madhya Pradesh (n=80).

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield obtained (kg/ha)</th>
<th>Research station yield (A)</th>
<th>Demonstration yield (B)</th>
<th>Farmers yield (C)</th>
<th>Yield gap-I (A-B)</th>
<th>Yield gap-II (B-C)</th>
<th>Yield gap (%) (B-C/B) *100</th>
<th>Technology index (%) (A-B/A)*100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickpea (JG 63)</td>
<td>2000</td>
<td>1211</td>
<td>946.25</td>
<td>789</td>
<td>264.75</td>
<td>21.9</td>
<td>39.4</td>
<td></td>
</tr>
<tr>
<td>Chickpea (JG 315)</td>
<td>2000</td>
<td>1245</td>
<td>823.23</td>
<td>755</td>
<td>421.75</td>
<td>33.9</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>Pigeonpea (TJT 501)</td>
<td>2100</td>
<td>1287.5</td>
<td>839.2</td>
<td>712.5</td>
<td>448.3</td>
<td>34.82</td>
<td>35.6</td>
<td></td>
</tr>
<tr>
<td>Pigeonpea (JKM 189)</td>
<td>2000</td>
<td>1182.5</td>
<td>755.9</td>
<td>817.5</td>
<td>426.6</td>
<td>36.1</td>
<td>40.1</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2:** Over all yield gap analysis in Pulses in Maharashtra (n=80).

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield obtained (kg/ha)</th>
<th>Research station yield (A)</th>
<th>Demonstration yield (B)</th>
<th>Farmers yield (C)</th>
<th>Yield gap-I (A-B)</th>
<th>Yield gap-II (B-C)</th>
<th>Yield gap (%) (B-C/B) *100</th>
<th>Technology index (%) (A-B/A)*100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickpea (Jaki 9218)</td>
<td>2020</td>
<td>1392.5</td>
<td>964.85</td>
<td>627.5</td>
<td>427.65</td>
<td>30.71</td>
<td>31.1</td>
<td></td>
</tr>
<tr>
<td>Chickpea (Digvijay)</td>
<td>1900</td>
<td>1505</td>
<td>986.4</td>
<td>395</td>
<td>518.55</td>
<td>34.4</td>
<td>20.8</td>
<td></td>
</tr>
<tr>
<td>Pigeonpea (PKV Tara)</td>
<td>1950</td>
<td>1450</td>
<td>891.4</td>
<td>500</td>
<td>558.63</td>
<td>38.5</td>
<td>25.6</td>
<td></td>
</tr>
<tr>
<td>Pigeonpea (ICPL 8863)</td>
<td>1950</td>
<td>1293</td>
<td>839</td>
<td>657</td>
<td>454</td>
<td>35.1</td>
<td>33.7</td>
<td></td>
</tr>
</tbody>
</table>
Contrary to the assumption that variety JKM 189 was the most advantageous, the technology index of the pigeon pea varieties indicated that variety JKM 189 (T.I. 35.6 %) was more advantageous than variety TJF 501 (T.I. 40.1 %). Hence, there is a need to develop location specific and low cost technology of pulses to the farmers with suitable extension interventions at farmers' field. These findings were consistent with the findings of Burman et al. (2008), Kumbhare et al. (2014) and Dutta (2014).

**Constraints in production of major pulses:** The overall yield gap analysis in major pulses (chickpea and pigeonpea) in Maharashtra is given in Table 2 revealed that technology gaps (yield gap-I) were observed less than extension gap (yield gap-II) in varieties of both the crop except variety Jaki 9218 of chickpea and ICPL 8863 variety of pigeon pea. Among chickpea varieties, Digvijay was observed more yield gap (34.4 %) than variety Jaki 9218 i.e. (30.71%). In pigeon pea, yield gap-I was observed from 395 to 627 kg/ha, whereas yield gap-II was observed from 427 to 518 kg/ha. In pigeon pea, yield gap-I observed from 500 to 657 kg/ha, whereas yield gap-II was observed from 454 to 558 kg/ha. And among pigeon pea varieties, PKV-Tara was having more yield gap (38.5 %) than variety ICPL 8863 i.e. (35.1%). The technology index of the chickpea varieties revealed that variety Digvijay (T.I. 20.8 %) was found more feasible than variety Jaki 9218 (T.I. 31.1 %). Also, the technology index of the pigeon pea varieties revealed that variety PKV-Tara (T.I. 25.6 %) was found more feasible than variety ICPL 8863 (T.I. 33.7 %). Hence, there is a need to focus on suitable extension interventions to the extension gap at farmers’ field. These findings were in line with the findings of Burman et al. (2008), Kumbhare et al. (2014) and Dutta (2014).

The production constraints faced by the farmers in cultivation of major pulses (pigeon pea and chickpea) is given in Table 3. The major production related constraints perceived by the respondent of both the states were low market price/low profit (74.39) and crop damage by wild animals (74.39) was observed first rank followed by non-availability of labour (53.43), high cost of inputs (53.37), lack of subsidy for inputs (45.55), non-availability of credit facilities (44.16), lack of proper information sources (36.80) and lastly the theft of crop at the time of maturity (20.00). Similar constraints also reported by Kumbhare et al. (2014).

The data related to factors for yield losses in major pulses (pigeon pea and chickpea) perceived by the respondents is given in Table 4. It is observed from the above data that highest losses were observed from the wild animals damage to crop (65.5 %) followed by high infestation of pests and diseases (62 %), drought / lack of rainfall (60 %), low/high temperature (58.3 %), theft of crop at harvesting (55.5 %), lack of storage facility (48.2 %) and lack of storage knowledge (42.6 %). It is observed that there were major yield losses in pulses due to wild animals like wild pig, monkeys, blue bulls in both the states of Maharashtra and Madhya Pradesh, hence, there is need to develop suitable policy initiatives by the government to reduce losses from wild animals. Also suitable extension interventions are required for management of pest and diseases in pulses.

**Suggested extension interventions:** Pulses are the most important part of our diet. It is both tradition and compulsion to the Indian households to consume pulses. The following extension interventions are suggested to reduce the yield gaps in pulses:

- The technology gap in pulses (pigeon pea and chickpea) was observed more than extension gap at farmer’s field. Hence, the extension interventions are needed to reduce the technological gap as well as extension gap in pulses at farmers’ field.
- Well defined location specific package of practices need to be developed for soil testing, seed rate, seed treatment, plant population, foliar spray, irrigation schedule and methods, use of bio fertilizers and on-farm testing and demonstrations at farmers field as a technological interventions to reduce the yield gap I (technology gap).
- Transfer of technology in relation to pulses need to be strengthened in a farmer participatory mode with active involvement of multidisciplinary team of researchers to reduce the extension gap (Gap-II).
- Policy initiatives for management of wild animals as they damage the crop completely. For management of wild animals, government needs to develop Special Park in the forest area for the animals like blue bull park, wild pig park and Monkey Park and special campaign to catch these animals and put them in the reserved park.
- Government need to ensure modern storage facilities to pulses growers for storage of their produce and also government should promote value addition, grading.
packaging and marketing of their pulses products in a group approach.

- Government need to establish of custom hiring centres in the villages to promote mechanization in the area.
- Extension agencies need to develop and disseminate of location specific package of practices of pulses and need to ensure adequate quality and timely availability of inputs.
- For availability of genuine seeds of HYVs of pulses to the farmers, state government in collaboration with research organization needs to develop ‘Seed Hub’ for production of recommended variety seed of location specific area.
- State government in collaboration with *Krishi Vigyan Kendra* need to organize Farmers Field Schools and special awareness campaign for pulses.
- Minimum Support Price (MSP) in pulses needs to be enhanced by the Government to assure better price to the farmers.
- Also extension interventions is required to facilitate the farmers for direct marketing (producer to consumer) to eliminate middlemen/commission agents in the marketing channel to assure better price to the farmer and consumers.
- Besides, government need to give special packages for pulses growers, ensure timely availability of credit specialties and need to develop irrigation potential in the pulse growing areas to enhance the production and productivity of pulses.

**CONCLUSION**

Pulses are the most important part of our diet. It is both tradition and compulsion to the Indian households to consume pulses. Hence, there is need to reduce the yield gaps and constraints to enhance the production of major pulses for food and nutritional security. The technology gap in pulses (pigeon pea and chickpea) was observed more than extension gap at farmer’s field, thus the suitable extension interventions are needed to reduce the technological as well as extension gap in pulses at farmers’ field for the benefit of farmers.

**REFERENCES**


Masood Ali and Gupta (2012). Carrying capacity of Indian agriculture: pulse crops. IIPR. Kanpur, India


Reddy, A. A. (2010). Regional disparities in food habits and nutritional intake in Andhra Pradesh, India.