Front line demonstration on lentil using improved varieties for increasing productivity under lateritic soil of West Bengal

Subrata Mandal*, Prabuddha Ray, Sourav Mondal and Palash Ankure

Rathindra Krishi Vigyan Kendra, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, Birbhum-731 236, West Bengal, India.

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ABSTRACT

Front Line Demonstrations (FLD) on lentil using improved varieties WBL-58 and WBL-77 were conducted during winter seasons of the year 2013-14 and 2015-16 respectively in the adopted villages of Rathindra KVK, PSB, Visva-Bharati, Sriniketan, Birbhum to show the higher production potentiality. The demonstrations were carried out in 32 farmers’ fields of 5 ha area and 79 farmers’ fields of 20 ha area during the year 2013-14 and 2015-16 respectively in irrigated medium land situation. The lateritic soils were sandy loam in texture having low in pH (6.0-6.4), O.C (0.39-0.47 %) and available P2O5 (16-19 kg /ha) and medium in N and K content. Lentil seeds @ 30 kg /ha was sown in the month of November after harvesting of short duration paddy. The technology of improved variety viz. WBL-58 and WBL-77 increased the average productivity by 26.5 % and 40.88 % and increased the net return by Rs. 7,900.00 with an improved B:C ratio of 2.71 instead of 2.27 and Rs. 15,240.00 with an improved B:C ratio of 3.74 instead of 2.95 than those of local check variety Asha during the both the years respectively. Beside that soil health and soil nitrogen was also improved along with better nodulation in the demonstration plots. Thus the technology of improved variety of lentil may be accepted economically for better utilization of the residual soil moisture after short duration rainy paddy.

Key words: B:C ratio, Front Line Demonstration (FLD), Lentil, Net return, Soil health, Yield.

INTRODUCTION

India is one of the major pulse producing countries contributing about 33 per cent of world area and 25 per cent of world production of pulses. Pulses are also an important component of Indian agricultural economy next to food grains and oilseeds in terms of acreage, production and economic value (Choudhary, 2009). The important pulse crops in India are chick pea, pigeon pea, mung bean, urd bean, lentil and field pea (Ali and Gupta 2012). However India’s rank in productivity is low, 24th in chick pea, 9th in pigeon pea, 23rd in lentil and 98th in total pulses (Reddy, 2004). In India, production of pulses is around 19.3 million tonnes (ESI, 2015) with a very low average productivity of 764 kg/ha. Currently, total area under pulses is 26.3 million ha (Choudhary and Suri, 2014). However, in the case of Lentil, the average yield in India (629 kg/ha) is 25 per cent lower than the world average (1053 kg/ha) (FAO, 2007).

There is a stark decline in the availability of pulses in the country from 69 g/capita/day in 1961 to 33 g/capita/day in 2009-10 (ICMR recommends 65 g/day/capita) (Ali and Gupta 2012). To overcome the problem of protein energy malnutrition, a minimum of 50 g pulses/capita/day should be available in addition to other sources of protein. Thus, to make the nation pulse sufficient, average yield level has to increase substantially up to 1200 kg/ha by 2020 (The Hindu 2005).

Due to the mismatch between supply and demand of pulses, prices of pulse crops have increased exorbitantly. Even though pulses are very important for India in terms of share of production and consumption, in term of importance, both farmers and government have ignored them. In India, the irrigated area under pulses was only 12 per cent, while under wheat and paddy, it was more than 60 per cent of the total area. (Materne and Reddy, 2007; Reddy, 2009).

Out of 14 Mt of pulses production, lentil contributes about 1.0 mt. lentil is an important *rabi* pulse crop next only to gram. Its share in the acreage and production of total *rabi* pulses is about 12 per cent, whereas in the overall pulses production, its share is about 6 per cent.

Lentil has shown a positive growth rate during both the periods (6.67 per cent per annum during 1982-1993 and 1.45 per cent per annum during 1994-2009). In the global context, India is the largest producer of lentil.

During the post-WTO regime, the export potential lentil has increased since India is the largest producer of pulses in the world. It indicates the need for wider adoption of low-cost technology among all pulse crops so as to meet the growing domestic as well as global demand. Among all pulses, lentil is the most actively traded pulse crop (about 25 per cent of world production is internationally traded).

*Corresponding author’s e-mail: smkvkvb@gmail.com*
The area, production and productivity of lentil crop in the district of Birbhum has been increased from 2008-09 to 2011-12 which is given in the following table.

Pulse productivity in India is much lower than other pulse producing countries. This is mainly because of unavailability of quality seed at desired time, cultivation on marginal and sub-marginal lands, injudicious use of fertilizers and non-adoption of crop management practices and poor marketing infrastructure (Chandra, 1994; Choudhary, 2013).

So, the National Agricultural Research System including ICAR Institutes, Agricultural Universities, All India Coordinated Research Projects and Krishi Vigyan Kendras to develop and demonstrate new technologies of various pulse crops. A large number of region-specific and widely adapted high yielding short duration varieties of pulses with tolerance to biotic and abiotic stresses have been developed. Kumar and Srivatava (2015) established the impact of reproductive duration on yield in lentil. ICAR has also made sincere efforts in producing required quantity of breeder seeds of major pulse crops. Since 2010-11 ICAR had envisioned to undertake well designed programme of Technology Demonstration for Harnessing Pulses Productivity through KVKs in 137 districts of 11 States by conducting frontline demonstrations every year. The results of these FLDs are very encouraging in showing production potential of various technologies in varying field conditions across the country. With the financial support from Ministry of Agriculture and Farmers’ Welfare, Govt. of India these efforts for harnessing pulses productivity need up scaling throughout the country in more number of districts identified by the Government under NFSM-Pulses.

It is felt that there is shortage of quality seeds of newer varieties of pulses. So, Krishi Vigyan Kendra (KVKs), a vast network of ICAR in the country, can play an important role in demonstrating the improved crop production technologies in farmer’s fields and multiplication of seeds. Under the scenario, the programme was undertaken with the following objectives:

- To minimise the problem of low yield of lentil
- To increase the area, production and productivity of lentil in the district
- To spread the technology of new improved variety throughout the district instead of local variety
- To increase the benefits of the farmers in the same time and same unit of land.

**MATERIALS AND METHODS**

Front Line Demonstrations (FLD) on Lentil using improved varieties WBL-58 and WBL-77 were conducted during winter seasons of the year 2013-14 and 2015-16 respectively in the adopted villages of Rathindra KVK, PSB, Visva-Bharati, Sriniketan, Birbhum to show the higher production potentiality than local check variety. The demonstrations were carried out in 32 farmers’ fields of 5 ha area and 79 farmers’ fields of 20 ha area during the year 2013-14 and 2015-16 respectively in different villages of Birbhum District. These Front Line Demonstrations (FLDs) were conducted in irrigated medium land situation. The lateritic soils were sandy loam in texture having low in pH (6.0-6.4), organic carbon (0.39-0.47 %) and available phosphate (16-19 kg P\textsubscript{2}O\textsubscript{5}/ha) content and medium in N and K content.

The problem of low productivity of lentil was analyzed through using Participatory Rural Appraisal (PRA) techniques like Focus Group Discussion and Group Discussion. From these analyses, it was found out that among the bio-physical constraints, the lack of good quality seed of new improved varieties were ranked first. In this context, the new improved varieties viz. WBL – 58 and WBL – 77 were selected for FLD to minimize the problem of low yield of lentil.

At first, the farmers’ fields were selected according to the potentiality and willingness of the probable partner farmers in 4 numbers and 12 numbers of different villages in different Community Development Blocks of Birbhum district of West Bengal in the year 2013-14 and 2015-16 respectively. On Campus farmers’ training were conducted to aware and impart knowledge about the new improved variety selected for demonstration in the partner farmers’ plots. The different features and potentiality of the demonstrated varieties were discussed comparing it to the Local Check Variety i.e. Asha. All the agronomic practices like seed rate, Rhizobium inoculation, Phosphate management, Weed management, micro-nutrient spraying etc. were discussed thoroughly to get the maximum.

The seed of the improved varieties were distributed @ 30 kg /ha. The sowing in all the demonstration plots was completed by 10\textsuperscript{th} November in both the years. All other agronomic practices were same as it was practiced in the Local Check plots.

The crops were totally managed by farmers. They shared all the inputs except the only critical inputs i.e. seeds of the improved variety which was shared by KVK.

At the time of maturity, field visit programmes were conducted in the demonstration plots in the every village. After harvesting and threshing, the yield data were obtained from individual partner farmers plots. Then weighted mean

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (ha)</th>
<th>Production (T)</th>
<th>Productivity (Kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-09</td>
<td>4533</td>
<td>2284</td>
<td>502</td>
</tr>
<tr>
<td>2009-10</td>
<td>4533</td>
<td>3552</td>
<td>784</td>
</tr>
<tr>
<td>2010-11</td>
<td>5261</td>
<td>3512</td>
<td>668</td>
</tr>
<tr>
<td>2011-12</td>
<td>5803</td>
<td>3644</td>
<td>628</td>
</tr>
</tbody>
</table>

*Source: Evaluation Wing, Directorate of Agriculture, Govt. of West Bengal.*
of the yield was calculated to obtain the average yield. Then total cost of cultivation was calculated on the basis of discussion with farmers. The price of the crop in the local market was used for calculation of gross return.

RESULTS AND DISCUSSION

From the (Table 2) it was noted that 32 numbers of Front Line Demonstrations (FLDs) on improved lentil variety i.e. WBL- 58 was implemented in 5 ha area during the year 2013-14 whereas, 79 numbers of FLDs on improved variety i.e. WBL - 77 was conducted in 20 ha area during the year 2015-16 considering the thematic area of varietal replacement.

The local check old variety i.e. Asha was replaced with the mentioned two improved varieties. In the year 2013-14, the seeds of improved variety WBL-58 were available for demonstration. Seeing the success of the programme, the area of the FLD was increased in the year 2015-16 with newer improved variety WBL-77.

The perusal of the data (Table- 3) on the performance of the FLDs clearly indicated that average yield of the crop lentil was increased by 26.5 per cent and 40.9 per cent in both the years respectively.

In the year 2013-14, the average yield of the demonstration of the variety WBL-58 was found 10.5 q/ha which was satisfactorily higher than those of the local check plots having the variety Asha (8.3 q/ha). Thus it minimised the yield gap by 48.8 per cent with reference to the potential yield of the improved variety i.e. 15 q/ha.

Similarly, in the year 2015-16, the average demonstration yield of the variety WBL-77 was found 9.65 q/ha which was remarkably higher than those of the local check yield of the variety Asha i.e. 6.85 q/ha. The yield gap with reference to potential yield of the variety WBL-77 (15 q/ha) was reduced by 52.3 per cent using the technology of improved variety. In Raisen, Madhya Pradesh Dubey et. al.,(2017) observed similar result in FLD on Chickpea.

It is noted that average demonstration yield and Local Check yield was lower in the year in the year 2015–16 than those of 2013 – 14. It might be due to climatic factors like more fogs in the year  2015–16.

Considering the economics of the programme (Table – 4), it might be depicted that demonstration of improved variety fetched higher B:C ratio of 2.71 and 3.74 in comparison to 2.27 and 2.95 as reported in the local check during 2013-14 and 2015-16 respectively. It implied that FLD on improved variety of lentil not only increased the yield but also fetched higher benefit cost ratio to tune of 19.4 per cent and 26.8 per cent during both the years respectively. Though cost of cultivation was higher in Lentil but due to higher price of Lentil in the market played a great role in such positive economics of the crop. Extra net returns of Rs. 7,900.00 / ha and Rs. 15,240.00 / ha during the year 2013-14 and 2015-16 were obtained due to higher yield potential of the improved variety. This might be due to suitability of those varieties to the micro-climatic situation and soil condition of Birbhum district. Similar type of results were obtained by Tripathi (2016) at Bundelkhand region of Madhya Pradesh.

More yields of the improved varieties (WBL – 58 and WBL – 77) were obviously due to more root ramification and better nodulation of the crop. Thus decaying of large number of roots and nodules improved the soil organic Carbon and available Nitrogen content after the harvest of the crop and thus maintained the soil health and sustainability.

<table>
<thead>
<tr>
<th>Year</th>
<th>Variety</th>
<th>Thematic Area</th>
<th>Technology Demonstrated</th>
<th>Area (ha)</th>
<th>No. of Farmers / Demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013–14</td>
<td>WBL – 58 (Subrata)</td>
<td>Varietal replacement</td>
<td>Improved Variety</td>
<td>5</td>
<td>32</td>
</tr>
<tr>
<td>2015–16</td>
<td>WBL – 77 (Moitree)</td>
<td>Varietal replacement</td>
<td>Improved Variety</td>
<td>20</td>
<td>79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Improved Variety</th>
<th>Local Check Variety</th>
<th>Average Demonstration Yield (q / ha)</th>
<th>Local Check Yield (q / ha)</th>
<th>Increase in Yield (%)</th>
<th>Potential Yield of Improved Variety (q / ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013–14</td>
<td>WBL – 58 (Subrata)</td>
<td>Asha</td>
<td>10.5</td>
<td>8.3</td>
<td>26.5</td>
<td>15.0</td>
</tr>
<tr>
<td>2015–16</td>
<td>WBL – 77 (Moitree)</td>
<td>Asha</td>
<td>9.65</td>
<td>6.85</td>
<td>40.9</td>
<td>15.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Variety</th>
<th>Farmers' Existing Plots (Local Check)</th>
<th>Demonstration Plots (Improved Variety)</th>
<th>B:CRatio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>WBL- 58 (Subrata)</td>
<td>14620</td>
<td>18580</td>
<td>2.27</td>
</tr>
<tr>
<td>2015-16</td>
<td>WBL- 77 (Moitree)</td>
<td>13925</td>
<td>27185</td>
<td>2.95</td>
</tr>
</tbody>
</table>
CONCLUSION
After completion of the FLD programmes, it might safely be stated that improved variety of Lentil were found successful to minimise the yield gap and to increase the area, production and productivity of Lentil in the Birbhum District of West Bengal. Further it may also be noted that replacement of old local variety of Lentil may successfully be adopted by using the improved varieties of WBL-58 or WBL-77. Beside the vertical improvement of the productivity of Lentil, horizontal spread of the technology is also ensured due to improvement of economics of production of Lentil in specific and pulse in broad sense. Therefore, farmers will be definitely benefited by cultivation of Lentil using the improved varieties WBL-58 and WBL-77 after kharif Paddy in lateritic soil of Birbhum District of West Bengal in a sustainable manner.

REFERENCES