

FARMERS' PARTICIPATORY EVALUATION OF POTATO GENOTYPES TO LATE BLIGHT UNDER DIFFERENT AGRO CLIMATIC CONDITIONS OF NEPAL

Buddhi P. Sharma¹, Hari B. Khatri-Chhetri², Birendra B. Rana¹, Surendra L. Shrestha³
Yamuna P. Sah⁴ and Khem R. Sharma⁵

¹ National Potato Research Programme

² Entomology Division

³ Regional Agriculture Research Station, Parwanipur

⁴ Agriculture Research Station, Belachapi

⁵ Agriculture Research Station, Dailekh

ABSTRACT

*Farmers' participatory multi location field experiments were conducted in 2011/12 with the objectives of evaluating late blight disease [*Phytophthora infestans* (Mont) de Barry] resistant and high yielding potato genotypes. Twenty two promising potato genotypes which have been selected through the series of experiments since 2006, were tested in farmers' fields at Dhikure (Nuwakot), Parwanipur (Bara), Belachapi (Dhanusa), Sonpur (Dang) and Kimugaun (Dailekh) involving two to four farmers in each location. A farmer's field trial (FFT) set per farmer, composed of 6-15 genotypes, were planted in the plot size ranging from 3 to 6 m² during the respective potato planting season. Potato cultivars Desiree and Kufri Sindhuri in Bara, Lalgulab in Dhanusa, MS-42.3 and Cardinal in Nuwakot and Tharu Local in Dang were used as check to compare with test genotypes. Fungicide against any disease was not sprayed throughout the crop period. Late blight severity as foliage damage % was recorded at 70-75 days after planting. Crop was harvested at 90-110 days after planting depending on the location and farmers decision. Genotype PRP-266264.01 produced the highest tuber yield (46.67 t/ha) followed by PRP-266264.15 (41.67 t/ha) in Dang, LBR-40 (37.17 t/ha) and CIP-384321.15 (31.83 t/ha) in Nuwakot, PRP-266264.15 (17.9 t/ha) in Dhanusa, PRP-25861.1 (26.37 t/ha) and PRP 266264.01 (22.66 t/ha) in Parwanipur, BSUPO3 (47.05 t/ha) and PRP-266264.01 (44.33 t/ha) in Dailekh. Tuber yields of these genotypes were significantly higher as compared to the yields of respective local check cultivars ranging from 2.8 to 13.33 t/ha.*

Key words: late blight, participatory, potato cultivars, tuber yield

INTRODUCTION

Potato (*Solanum tuberosum* L.) is the world's third food crop. It is fourth most important food crop in Nepal after rice, maize and wheat which act as one of the most important commodities for food security (Khatri and Rai, 2000). Despite of having its high yielding capacity, the average productivity of potato is 13.7 t/ha (MOAD, 2011) which is very low as compared to the developed countries. Late blight [*Phytophthora infestans* (Mont) de Barry] is the major yield reducing factor in Nepal. In high hills (>2000 masl), yield loss in potato due to late blight has been recorded up to 90 percent (Shrestha and Kharel, 1996; Shrestha, 1997). It may cause 100 percent yield loss under favorable conditions for disease development. A loss in yield is generally recorded every year in Nepal; however, in terai, late blight appeared in epidemic form with 2-3 years intervals whereas in the hills it occurs annually (Ojha et al., 1998). The international Potato Center (CIP) has estimated a production loss of 15 percent in potato in developing countries due to late blight with an annual fungicide use in developing countries amounting to 750 million USD (CIP, 1997).

National production of potato during 2010/11 was 2508044 mt from 182600 ha of land. If we estimate the minimum level of 20 percent yield loss due to late blight, the national economic loss would go beyond 9.4 billion rupees. Furthermore, a large number of fungicides such as mancozeb, copper oxychloride, metalaxyl, fenamidone and propineb have been used for controlling late blight and all these fungicides cause environmental pollution and are carcinogenic. Continuous use of these chemicals lead to development of resistance in the pathogen (Maharjan, Shrestha and Basnyat, 2010). With regard to disease management, most of the farmers' apply fungicides 10-15 times to control late blight depending on crop season and disease severity (Sharma and KC, 2004). The fungicide cost may go above Rs. 1.4 million in the Nepalese context. The level of late blight

resistance in presently available potato varieties is only intermediate and access of resistant varieties to the farmers is often limited and fungicides are too costly for resource poor farmers of Nepal (Sharma et al., 2009).

Among various late blight management options, use of resistant varieties is the most economic, environment-friendly and best option for organic farming. A lot of time, energy and money are being spent for the development of resistant varieties. Unfortunately, the resistance is not stable. Potato variety development for resistant to late blight is a continuous process after evaluation in on-station trials as initial evaluation trial (IET) and coordinated varietal trial (CVT). Promising genotypes needs to be verified under multi location farmer's field conditions. The main objective of the experiment was to study the sustainability of host resistance and tuber yield across the locations with farmer's active participation. The second objective was to scale up the late blight resistant genotypes in different parts of Nepal.

MATERIALS AND METHODS

Field experiments were conducted in randomized complete block design with farmer as a replication in different outreach sites in collaboration with Regional Agricultural Research Station, Parwanipur; Agriculture Research Stations, Belachapi and Dailekh. Twenty five promising potato genotypes which have been selected through the series of experiments since 2006, were tested in farmers' fields of Dhikure (Nuwakot), Parwanipur (Bara), Belachapi (Dhanusa), Sonpur (Dang) and Kimugaun (Dailekh) involving two to four farmers in each location. A farmer's field trial (FFT) set per farmer, composed of 6-15 genotypes, were planted in the plot size ranging from 3 to 6 m² during the respective potato planting season. Potato cultivars Desiree and Kufri Sindhuri in Bara, Lalgulab in Dhanusa, MS-42.3 and Cardinal in Nuwakot and Tharu Local in Dang were used as check to compare with test genotypes. Prior to planting, fertilizer 150:100:60 kg NPK/ha along with 20 t/ha farm yard manure/compost were applied as basal dose. Intercultural operations and irrigation was applied as per farmer's decision. Experiments were conducted in natural epiphytotic conditions. Fungicide against any disease was not sprayed throughout the crop period. Late blight severity as foliage damage % was recorded at 70-75 days after planting. Crop was harvested at 90-110 days after planting depending on the location and farmer's decision. Genotypes were evaluated by farmers themselves with their end use perspective.

RESULTS AND DISCUSSION

Dang

The trial was conducted during autumn season (October), and the weather in December usually was the most conducive for late blight development in Deokhuri valley. Among the tested varieties, Kufri Jyoti exhibited the highest foliage damage (100%) followed by Tharu Local (80%). Genotype CIP-394050.110 showed susceptibility whereas PRP-266264.01, CIP-384321.15 and PRP-266264.15 were found resistant to late blight (Figure 1). The highest tuber yield was obtained from PRP-266264.01 (46.67 t/ha) followed by PRP-266264.15 (41.67 t/ha). These high yielding varieties were resistant to late blight in mid-western Deokhuri valley conditions.

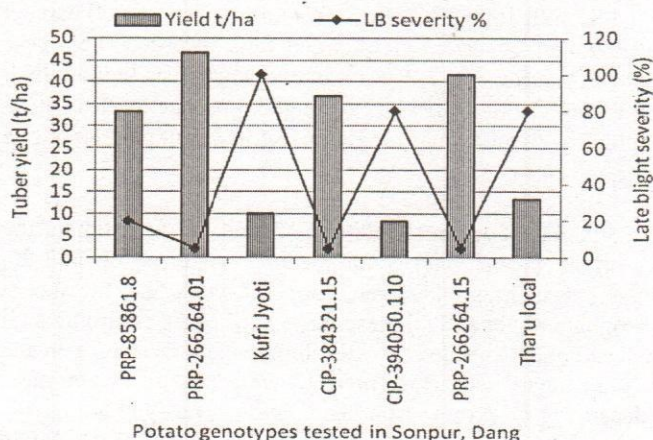


Figure 1. Performance of potato genotypes to late blight severity and tuber yield at Sonpur, Dang

Nuwakot

Among the fifteen different genotypes screened against late blight disease in Dhikure, Nuwakot, genotypes LBr-40, CIP-384321.15, CIP-393385.39 and CIP-392657.8 were found highly resistant against late blight. The check variety Cardinal and MS-42.3 were found highly susceptible to late blight (Figure 2). The highest tuber yield was obtained from LBr-40 (37.17 t/ha) followed by CIP-384321.15 (31.83 t/ha), PRP-266264.01 (29.33 t/ha), PRP-266264.15 (29.33 t/ha) and PRP-25861.1 (23.5 t/ha). Despite of disease resistant and high yielding capacity majority of participating farmers were reluctant to select LBr-40 for further seed multiplication, just because of white skin. Farmers preferred PRP-25861.1 because of disease resistance, red skin and considerable tuber yield. Existing widely adopted cultivar MS-42.3 was found highly susceptible (81% foliage damage) and yielded very low (4.2 t/ha). This genotype was neither released nor registered but the farmers and consumers prefer because of its cooking quality and acceptable level of field tolerance to late blight. Presently, susceptibility of MS-42.3 has increased and farmers have been applying fungicide 10-15 times to manage the late blight.

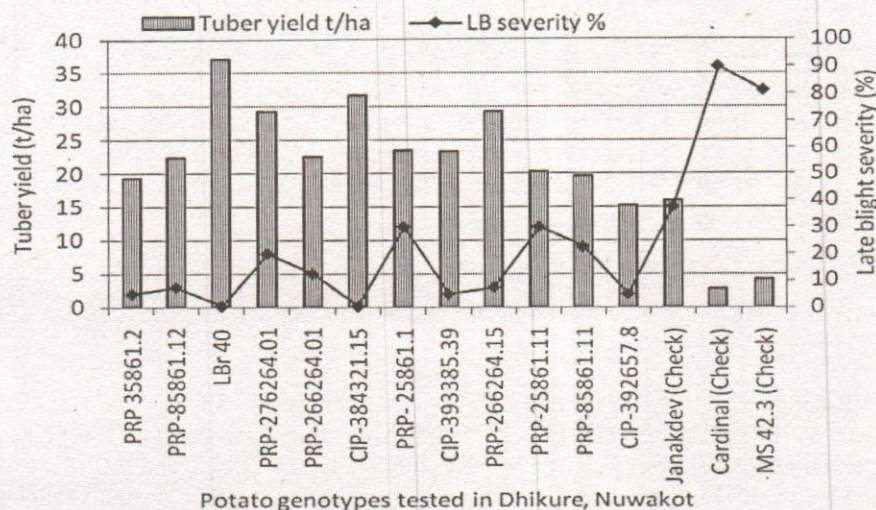


Figure 2. Performance of potato genotypes to late blight severity and tuber yield at Dhikure.

Dhanusa

Genotype PRP-266264.15 was observed resistant to late blight while other varieties were found susceptible (Figure 3). Check variety Lalgulab was found severe with foliage damage of 90 percent. The highest yield was obtained from PRP-266264.15 (17.9 t/ha) followed by Kufri Jyoti (13.4 t/ha). Kufri Jyoti was found better with respect to foliage damage and tuber yield than Lalgulab (11.37 t/ha). Over all tuber yields of test genotypes in this location were low as compared to other locations. Major cause might be the poor soil fertility of the experimental plots. Because of colour and availability of sprouted seed tubers at cheaper rate during the planting time 'Lalgulab' has been adopted in some pocket areas of central terai region. Since PRP-266264.15 was found late blight resistant, red skinned tubers and high yielder at Dhanusa, it is expected that this genotype would be adopted by the farmers.

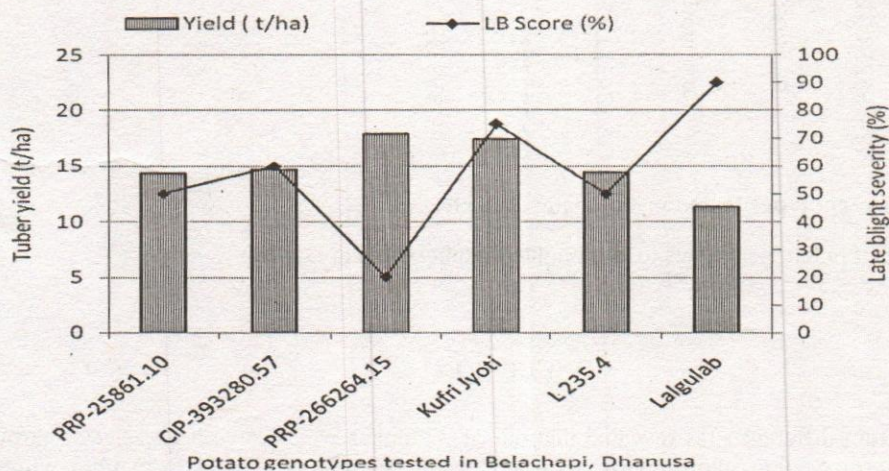


Figure 3. Performance of potato genotypes to late blight severity and tuber yield at Dhanusa

Bara

Genotypes PRP-266264.01 and PRP-266264.15 were observed resistant to late blight while PRP- 25861.1, PRP-85861.8, PRP-85861.12 and PRP-276264.01 were found moderately resistant (Figure 4). The highest tuber yield was obtained from PRP-25861.1 (26.37 t/ha) followed by PRP-266264.01 (22.66 t/ha), PRP-276264.01 (19.4 t/ha) and PRP-266264.15 (18.31 t/ha). All the check cultivars, Desiree, Kufri Jyoti and Kufri Sindhuri were found highly susceptible to late blight and produced lower tuber yield as compared to most of the late blight resistant genotypes.

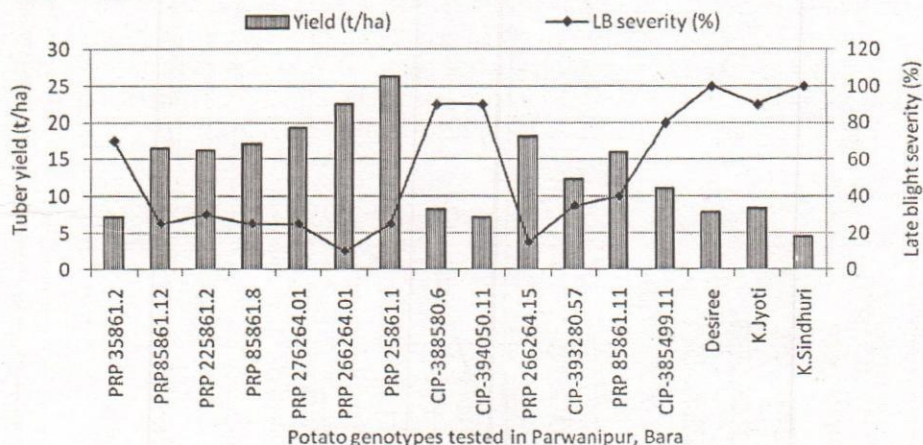


Figure 4. Performance of genotypes to late blight severity and tuber yield at Parwanipur

Dailekh

Genotypes PRP-266264.01, PRP-85861.8 and CIP-384321.15 observed resistant to late blight while BSUPO3 was moderately resistant (Figure 5). PRP-85861.11 and CIP-393385.39 were found susceptible. The highest tuber yield was obtained from BSUPO3 (47.05 t/ha) followed by PRP-266264.01 (44.33 t/ha) and PRP-85861.8 (26.67 t/ha). Kufri Jyoti showed below 40% foliage damage at Dailekh as compared to other locations ranging from 80-100% foliage damage.

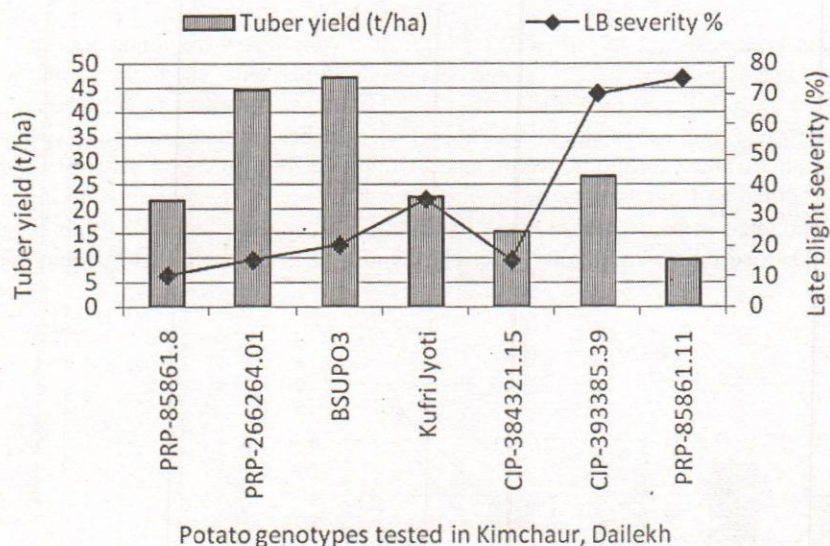


Figure 5. Performance of potato genotypes to late blight and tuber yield at Dailekh

CONCLUSION

The results obtained from different sites revealed that out of 22 clones which have been selected through the series of experiments since 2006, nine clones performed better with higher yield (>20 t/ha) without any fungicide application. Most of them have very low late blight severity. LBr-40 was liked by the farmers of Sonpur, Dang but majority of farmer's of other locations had preferred PRP-25861.1, PRP-266264.01, PRP-

266264.15 and CIP-384321.15 because of their red skin, bright appearance, late blight resistance and higher tuber yield. BSUPO3 performed excellent in producing the highest yield at Dailekh (Figure 6) than all the test genotypes. Although the performance of nine genotypes were found better in aggregate further researches need to be carried out on storability, culinary, organoleptic test and processing qualities of promising genotypes. If these disease resistant genotypes are adopted cost of production, environmental pollution, health hazardous due to pesticide consumption will be minimized and also will support for organic potato production. However, farmers do not select only for late blight resistance. They are more concerned for an appropriate combination of yield, late blight resistance, culinary quality and marketability.

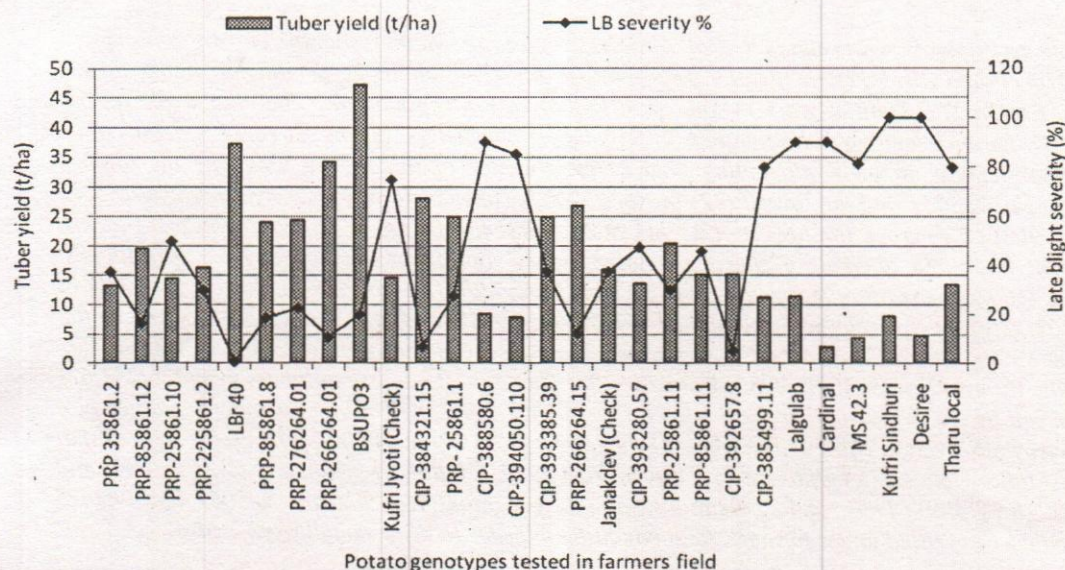


Figure 6. Performance of potato genotypes to late blight and mean tuber yield of the location

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