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Evaluation of CIP Potato Germplasm for Late Blight Resistance During Summer Season in Sharan, Kaghan Valley

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Abstract: Evaluation of potato germplasm was carried out in Sharan, Kaghan valley against late blight. Results of the trial presented in the tables 1and 2 revealed that the CIP clone, 387348-20 showed maximum resistance against late blight with rating scale 3. Other three clones (383120-14, 387315-27 and 387015-13) were found resistant to late blight with score 4, as late blight infection was less than 50%. Two clones, 382178-14 and 381245-5 reflected 50% resistance with late blight score of 5. Other clones were found highly susceptible to late blight with late blight score of more than 50%. Some clones having late blight resistance may replace the existing varieties to save the chemical expenses to control late blight of potato crop at farmers' field.

Key words: Late blight resistance, *Phytophthora infestans*, potato, *Solanum tuberosum*, germplasm evaluation, Pakistan

Introduction

Late blight is a fungal disease, caused by *Phytophthora infestans*, is the most devastating of all fungal diseases of potato in the hills of northern Pakistan. Infection and development of late blight depends upon environmental conditions. Normally, symptoms appear in the month of August in Northern areas, but it can destroy the crop at any time when climatic conditions are favorable (temperature ranges from10-20°C with humidity above 70% during growing season). Typical "light blight weather" is characterized by cool, overcast days with frequent rains and scarce sunshine (Farooq, 1987).

Turkensteen *et al*. (1986) conducted a survey of fungal and bacterial diseases of potato field crops in the mountainous areas in the northern parts of Pakistan to obtain knowledge on the importance of potato pathogens with respect to potato seed production and to indicate production constraints and risks due to disease and reported that out of 255 fields inspected, 125 samples were taken which resulted in 186 identified fungal isolates and 49 tested bacterial samples yielding 18 fungal and 3 bacterial organisms known to be potato pathogen. Among the fungal diseases, late blight, early blight, minor leaf spot, verticillium wilts, solerotinia wilt, stalk break, rubbery rot, black scurf, collar rot and powdery mildew were detected.

Annually, the losses caused by late blight reach 50% of total yield. Farmers need resistant varieties to replace the traditional ones that are susceptible to late blight. To fulfil this need, germplasm received from International Potato Center (CIP) were evaluated against late blight in high hills of Sharan, Kaghan valley.

Materials and Methods

Evaluation of 21-potato clones received from International Potato Center (CIP) was carried out in Sharan, Kaghan valley against late blight during summer season of 1998 and 1999. Experiments were laid out in Randomized Complete Block Design (RCBD) with three replications and 21 treatments (germplasm). The clones were sown on 18-06-1998 and 10-06-1999. The potato variety, Desiree was used as control in the trial. The plot size was kept 6.75 m^2. The crop of 1998 trial was harvested on 15-10-1998 and the other was harvested on 10-10-1999. Data regarding emergence % age, number of stems m^{-2}, %age of marketable yield, late blight score and yield (t ha^{-1}) was recorded (Table 2 and 3). In addition, color, shape, eye depth and general appearance (GA) of tubers for each variety (Table 1) was also noted (GA stands for over all look of potato tuber and recorded in scale 1 to 9, where 9 stands for excellent and 1 stands for very poor).

Results and Discussion

Late blight infection appeared in third week of September and susceptible varieties were completely died. From the data in Table 2, it is obvious that the CIP clone, 387348-20 showed good resistance, with late blight rating score of 3. Other three clones, 383120-14, 387315-27 and 387015-13 with late blight rating score of 4 showed partial resistance, as late blight infection was less than 50%. Other clones were found more than 50% susceptible.

Late blight infection was almost same in both the trials, i.e. 1998 & 1999. During the trials it was noted that the CIP clones with late blight resistance gave maximum yield. The clone, 387015 produced highest yield, i.e., 35.56 t ha^{-1} in 1998, and 38.33 t ha^{-1} in 1999 (Table 2 and 3). However, the clone, 387348-20 had highest late blight resistance, but could not produce better yield (26.89 t/ha) in the 1998 trial, due to late maturity. It was also observed that in most cases the late blight resistant clones had late maturing character. Late maturing varieties are not fit in potato growing seasons (autumn and spring). Qunbao *et al*.(1994). They conducted six experiments to screen 19 advanced and 133 newly introduced clones for late blight resistance and noted that three of the advanced clones, 800946, CFK69.1 and 1-1039 had a late blight disease rating of less than 5. Five clones, i.e., Huinkul, Serrana, 38.6, 1-1085 and Mex-32 had late blight rating of 5 to 8 (moderate resistance). Mira, 378711.7, Cosima, K. Jyoti and CIP-24 (B71240.2) were susceptible to late blight. CIP-24 was highly resistant to late blight during initial evaluation but became susceptible in succeeding evaluations. It was also recorded that the clones with high or moderate level of resistance had acceptable yields of over 22.5 t ha^{-1}, while susceptible clones yielded less than 20 t ha^{-1}. Significant negative correlation was obtained among tuber yield, canopy cover and late blight ratings. They also recorded that two clones, 380019.2 and 387193.21 yielded over 25 t ha^{-1}, and had high resistance to late blight in the field. Among the set of clones introduced from CIP in 1993, 15 performed well with tuber yields per hill over 1.0 Kg and late blight rating of less than 4.

Khan *et al*. (1994) conducted nine on-farm research trials to test the affectivity of two fungicides in controlling late blight. They noted that the first symptom of late blight on foliage appeared in mid August. By mid September, the non-treated plants were totally destroyed.

Ganga *et al*. (1994) conducted approximately 45 evaluation/screening trials in which 469 cultivars and clones were evaluated on-station and in farmers' fields. In addition, about 75000 TPS and tuber families were evaluated. They observed a significant correlation between late blight rating and number of

Table 1: Late blight infection system used in the trial (Henfling, 1979).

Score	% late blight	Description
1	0	None or very low number of lesions within the row
2	3	More than 0% but less than 10%
3	10	Lesions are easily seen at close distance
4	25	About 25% of the foliage is covered with lesions or destroyed
5	50	Half of the foliage destroyed
6	75	75% of each plant is affected
7	90	Only top leaves are green
8	97	Only very few green areas are left
9	100	Foliage completely destroyed

Table 2: Evaluation of CIP germplasm against late blight in Sharan (summer, 1998)

Variety Clone^{-1}	Emergence %	Stems m^{-2}	Late blight infection 1	2	3	Market yield (%)	Yield t ha^{-1}	Color	Shape	Eye	GA*
381132-200	87	16	2	4	8	88	20.67	Red	Oval	Shallow	8
381132-63	93	17	2	4	8	89	17.56	Red	Oval	Shallow	7
382178-14	67	12	2	3	5	94	23.78	Blue	Round	Shallow	6
383120-14	90	17	2	3	4	87	20.89	White	Oval	Shallow	8
384093-844	100	17	2	4	7	78	28.22	Red	Round	Shallow	6
384868-1	100	24	2	5	9	94	27.33	White	Oval	Shallow	7
385270-163	93	15	2	5	9	89	22.89	Red	Oval	Shallow	7
386733-3	93	14	2	5	9	92	18.89	White	Round	Shallow	6
387315-27	93	18	2	3	4	85	22.67	Red	Oval	Shallow	7
Desiree	100	20	2	5	9	87	22.67	Red	Oval	Shallow	7
704159	93	15	2	5	9	98	26.22	Red	Oval	Shallow	7
720092	97	13	2	4	8	95	16.67	Red	Oval	Shallow	7
720157	93	13	2	4	8	89	26.44	Red	Oval	Shallow	8
720158	97	19	2	5	9	90	27.33	Red	Oval	Shallow	7
720162	93	16	2	5	9	89	17.89	Red	Oval	Shallow	7
800048	90	16	2	4	9	98	18.78	Red	Oval	Shallow	8
8381245-	83	13	2	3	5	96	26.22	White	Round	Shallow	7
384868-	100	23	2	4	8	80	24.22	Red	Oval	Shallow	6
387015-	93	15	2	2	4	86	35.56	White	Round	M.d	5
387348-	93	12	2	2	3	90	26.89	White	Oval long	Medium Deep	6 5
800081	93	24	2	5	9	96	21.00	Red	Oval	Shallow	7
LSD	20.4	6.9				9.74	11.78				

* G.A. General appearance

Table 3: Evaluation of CIP germplasm against late blight in Sharan (summer, 1999).

Variety/ Clone	Emergence %	Stem m^{-2}	Late blight 1	2	3	Market yield (%)	Yield t ha^{-1}	Color	Shape	Eye	GA
381132-200	90	18	2	3	8	91	23.69	Red	Oval	Shallow	8
381132-63	98	19	2	2	8	92	21.33	Red	Oval	Shallow	7
382178-14	84	14	2	3	4	97	27.00	Blue	Round	Shallow	6
383120-14	94	19	2	3	4	89	22.33	White	Oval	Shallow	8
384093-844	95	17	2	5	8	81	31.33	Red	Round	Shallow	6
384868-1	96	22	2	4	9	96	33.00	White	Oval	Shallow	7
385270-163	97	17	2	6	9	91	25.33	Red	Oval	Shallow	7
386733-3	94	16	2	6	9	95	20.00	White	Round	Shallow	6
387315-27	94	18	2	3	4	86	24.33	Red	Oval	Shallow	7
Desiree	98	19	2	5	9	86	21.00	Red	Oval	Shallow	7
704159	94	16	2	5	9	93	27.00	Red	Oval	Shallow	7
720092	98	15	2	5	9	95	17.67	Red	Oval	Shallow	7
720157	95	14	2	5	9	94	28.67	Red	Oval	Shallow	8
720158	95	20	2	6	9	93	29.00	Red	Oval	Shallow	7
720162	96	18	2	5	9	91	19.00	Red	Oval	Shallow	7
800048	92	17	2	4	9	94	19.00	Red	Oval	Shallow	8
381245-5	86	14	2	3	5	97	26.67	White	Round	Shallow	7
384868-1	98	24	2	4	8	84	26.33	Red	Oval	Shallow	6
387015-13	96	17	2	2	4	87	38.33	White	Round	M.d	5
387348-20	96	14	2	2	3	93	36.33	White	Oval long	Medium Deep	6
800081	96	22	2	5	9	96	22.67	Red	Oval	Shallow	7
LSD	5.13	2.79				3.61	11.22				

plants infected. For artificial inoculation, 2000 zoospores ml^{-1} could be used in the laboratory and 3000 to 4000 zoospores ml^{-1} inoculation in the greenhouse or in the field. A highly significant late blight infection was observed in artificially inoculated plants (1-50%) compared to the naturally infected plants (1-15%). However, the efficiency of both techniques in causing disease infection was the same. From the research trials it is concluded that late blight infection was almost same in both the trials and the CIP clones with late blight resistance gave maximum yield. It was also noted that in most cases the late blight resistant clones had late maturing character.

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