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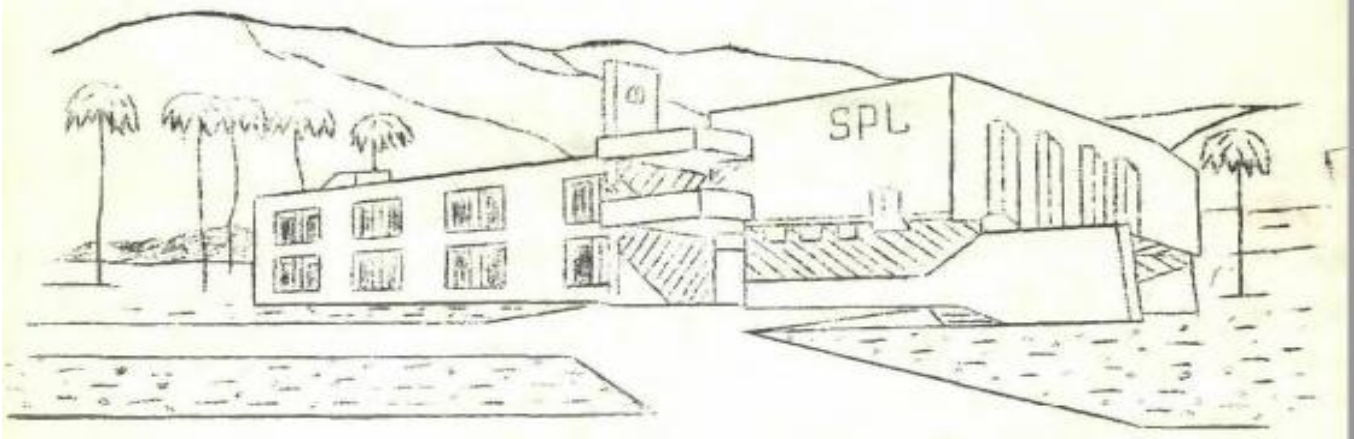

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AMBO–ETHIOPIA

RESEARCH HIGHLIGHTS OF POTATO DISEASES[1]

BY

Dr.B.Anisimoff, Tesfahun Fenta[2]

Introduction

Potato (Solanum tuberosum L) is one of the potentially important crops in Ethiopia. At present it is estimated that about 30.000 hectares of potato are grown annually in Ethiopia. This area has probably gone down the last few years because of the highly devastating epidemic of late blight Ph.infestans (Mont) de Bary in most of the major potato growing area of Ethiopia.

Late blight of potato is probably the most important diseases world wide. The history of long tedious struggle to a tale-won battle interspersed with disappointment and frustration. Meanwhile screening late blight resistant varieties, chemical control method, identifying of virulent races of Ph.infestans shall be integrated to control potato from late blight.

Trials are conducted every year in the Scientific Phytopathological Laboratory on potato diseases such as:

- Resistance to Late Blight;
- Identification of Race Composition of Ph.infestans;
- Fungicide Trial Against Late Blight of Potato;
- Assessment of Losses due to Late Blight of Potato;
- Potato Seed Treatment Trial Against Late Blight of Potato;
- Use of Meristem Culture Method for Eradication of Virus Diseases in Potato;
- Maintainance of Foundation of Potato Seeds.

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1. Paper presented at the 10th African Horticultural Symposium, Addis Ababa, Ethiopia, January 16-20, 1984.
2. Plant pathologists, SPL.

Resistance to Late Blight

Late blight of potato is believed to cause considerable damage in potato growing regions of Ethiopia. In order to select blight resistant and high yielders of potato varieties and clones a screening programme for general resistance to late blight was initiated in Ambo Scientific Phytopathological Laboratory . About 70 potato varieties and clones were obtained from international potato Center through the potato coordinator (College of Agriculture, Alemaya) and from other sources too. After two cycles of preliminary screening in Ambo, an advanced screening trial was conducted in 1983 crop season in Ambo - altitude 2250 m, Holetta - 2390 m, and Bako - 1650 m. In all the stations the trial was conducted in three replications. Plants were spaced 30 cm apart with in the row and 70 cm between rows, 10 tubers were planted in each row. All trials have been conducted under rainfed conditions.
A set of differential varieties was planted to observe the race diversification of Ph.infestans in all the three stations where the evaluation trial was conducted. Late blight was recorded starting the onset of the disease using 1-9 scale (CIP scale). Each plant of every row was recorded and blight intensity was calculated:

$$I + \frac{(a.b) * 100}{N.K.}$$

I: - Disease intensity.
(ab): - Number of infested plants - a
Multiplied by their respective score - b;
sum of their product - (ab);
N - Sum of all infected plants in a plot (sample)
K - The highest score

Different level of blight infestation was observed in all Stations. However, a number of clones has shown high yields and satisfactory field resistance to late blight (Table 1, 2, 3).

Table 1. Late blight progress in different recording dates

Ambo, 1983

Entry No	Varieties and clones	Late blight intensity, %				
		29.07	6.08	14.08	22.09	1.09
1.	Br - 114 - 60	0	0	0	0	20.7
2.	ATK - 69 - 1	0	25	31	45	79
3.	P 8	0	0	42	60	83
4.	Br - 112 - 113	0	0	20	52	72
5.	Avensa	0	0	0	0	35
6.	Cebeco	0	0	0	0	39
7.	Br - 114 - 34	33	75	85	100	100
8.	AL - 400	0	0	11	52	77
9.	R - 547 - 73	14	37	60	78	91
10.	R - 140 - 64	15	27	53	96	100
11.	R - 140 - 25	4	13	45	50	71
12.	R - 513 - 25	0	0	0	9	42
13.	Br - 114 - 114	0	0	0	0	35
14.	R - 88 - 64	44	51	70	87	94
15.	Kenya Baraka	0	0	14	32	36
16.	B - 5504	0	0	0	0	23
17.	Cex - 69 - 1	0	0	6	14	33
18.	Br - 112 - 64	0	0	13	24	42
19.	Anita	0	0	0	0	15
20.	Br - 114 - 131	53	67	84	100	100
21.	B - 5505	0	0	0	5	34
22.	Br - 114 - 26	32	50	55	72	82
23.	IND - 73	0	0	0	0	22
24.	Spunta	20	54	50	100	100
25.	Local	56	78	81	95	100

Table 2. Yield and blight reaction of potato varieties and clones grown in Ambo, Holetta, Bako in 1983.

Entry No	Varieties and clones	Ambo		Holetta		Bako	
		yield kg / plant	late blight % 1.09	yield kg/ plant	late blight % 1.09	yield kg/ plant	late blight % 1.09
1.	Br - 114 - 60	1.07	0	1.2	0	0.38	0
2.	ATK - 69 - 1	0.69	79	0.67	30	0.38	27
3.	P - 8	0.79	83	0.89	0	0.24	100
4.	Br - 112 - 113	1.05	72	0.79	44	0.50	0
5.	Avensa	1.14	0	0.99	0	0.30	33
6.	Cebeco	1.18	39	0.80	15	0.32	0
7.	Br - 114 - 34	0.33	100	0.21	100	0.43	0
8.	AL - 400	0.82	77	0.82	0	0.24	100
9.	R - 547 - 73	0.44	91	0.18	100	0.31	63
10.	R - 140 - 64	0.40	100	0.47	100	0.28	100
11.	R - 140 - 25	0.91	71	0.90	33	0.32	93
12.	R - 513 - 25	0.79	42	0.71	22	0.38	0
13.	Br - 114 - 114	0.91	0	0.95	0	0.37	67
14.	R - 88 - 64	0.56	94	0.18	100	0.40	59
15.	Kenya Baraka	1.09	36	1.18	0	0.42	0
16.	B - 5504	0.96	0	0.92	0	0.44	0
17.	Cex - 69 - 1	1.05	33	0.66	26	0.38	0
18.	Br - 112 - 64	0.82	42	0.54	41	0.42	0
19.	Anita	1.03	0	0.91	0	0.36	0
20.	Br - 114 - 131	0.26	100	0.31	100	0.43	11
21.	B - 5505	1.07	34	0.70	0	0.38	0
22.	Br - 114 - 26	0.56	82	0.28	89	0.42	0
23.	IND - 73	1.26	0	1.36	0	0.39	0
24.	Spunta	0.65	100	0.39	100	0.32	100
25.	Local	0.16	100	0.22	100	0.11	100

	Ambo	Holetta	Bako
Planting date	6.07.83	21.07.83	17.07.83
Harvesting date	28.10.83	30.11.83	30.11.83

Table 3. Some horticultural characteristics of evaluated potato varieties and clones.

Ambo, 1983.

Clones and varieties	Yield kg/plant	Marketable %	Unmarketable, %	Starch content,%
1. Br - 114 - 60	1.07	97.17	2.83	21.1
2. ATK - 69 - 1	0.69	96.3	4.37	19.1
3. P - 8	0.89	98.4	1.6	22.9
4. Br - 112 - 113	1.05	97.8	2.2	15.8
5. Avensa	1.14	94.17	5.83	19.5
6. Cebeco	1.18	98.6	1.4	20.1
7. Br - 114 - 34	0.33	93.6	6.4	19.4
8. AL - 400	0.82	97.87	2.13	20.2
9. R - 547 - 73	0.44	92.4	7.6	19.5
10. R - 140 - 64	0.40	95.9	4.1	17.2
11. R - 140 - 25	0.91	96.4	3.6	16.6
12. R - 513 - 25	0.79	97.93	2.07	17.9
13. Br - 114 - 114	0.91	97.77	2.23	20.7
14. R - 88 - 64	0.56	87.27	12.73	18.5
15. Kenya Baraka	1.09	98.2	1.8	20.5
16. B - 5504	0.96	100.0	-	17.7
17. Cex - 69 - 1	1.05	97.77	2.23	20.9
18. Br - 112 - 64	0.82	97.47	2.53	17.0
19. Anita	1.03	96.97	3.03	19.2
20. Br - 114 - 131	0.26	90.03	9.97	15.6
21. B - 5505	1.07	99.1	0.9	17.6
22. Br - 114 - 26	0.56	97.0	3.0	17.7
23. IND - 73	1.26	97.3	2.7	23.5
24. Spunta	0.65	98.03	1.97	14.2
25. Local	0.16	98.9	11.1	11.2

Except 6 clones all intries were attacked by late blight with a various degree of infestation and at different period of the disease onset under Ambo condition. However, most of the plants which were attacked lately gave good tuber yield of one or more kilogram per plant. At the plant population level used in this trial, a tuber yield of one kg per plant is almost equivalent to 40 tons per ha.

At Holetta 10 potato clones were not infected. In most cases those clones ware also have shown a very lower degree of infection and high yields under Ambo conditions too.

At Bako plants with no blight infection gave a tuber yield less than 1 kg per plant.

The lower tuber yield obtained in Bako in contrast to the yields in Holetta and Ambo was attributed to insufficient moisture and fertilizer.

It is possible to observe that Holetta and Bako where most of the differential varieties were infected, a high degree of infestation was recorded as compared with Bako.

Although the potato varieties and clones were evaluated mainly for blight resistance, and yield, some horticultural characterstics are presented in table 3.

There was a number of clones in Ambo, Holetta and Bako stations which gave tuber yields of more than 1 kg per plant. Even in these stations with moisture stress and other problems, there were at least some clones which gave tuber yields of more than 0.5 kg per plant, which is equivalent to more than 20 tons per hectare. In contrast to the local average yields of about 5 tons per hectare the yields and resistance of the new clones reported can be considered significantly high. The results obtained clearly indicate of the opportunity to select potato clones which may have a combined characterstics of high yielding capacities and field resistance to late blight.

Furthermore, in order to confirm their resistance and yield performance a continous screening should be conducted under different ecological conditions in Ethiopia.

Identification of race composition of Ph.infestans.

Assesment of races of Ph.infestans and its distribution was carried out on the population taken from different potato growing regions of Ethiopia: Debre-Zeit, Holetta, Ambo, Omo Garadella, Kulumsa, Bako, Jimma, Awassa (1982-1983).

Races composition of Ph.infestans were assessed and identified for 1982 - Race 4; 8; 10; 11 were identified from the samples taken at Ambo experimental field at the end of July and beginning of August: Local (Ambo), Siro, Cardinal, Bz-114-121, Br-112-93, Br-114-34. On the second half of August race 4; 7;8; 11; 2.3 were identified in the population taken from Br-114-121, Kenya Baraka, Br-112-42. On the first decade of September on ATK-69-1 and Br-112-113 all the above mentioned races were identified including race 1; 2; 3.4. Race 4; 8; 10; 11 were identified on B-5504 - sample collected from Holetta (collected 20.08). Race 4; 8; 10; 11; 2.3 were identified from the samples taken at Debre-Zeit on varieties Br-114-26, Br-114-41. Race 4; 8; 10; 11 were identified in all samples collected from different sites. Race 2.3; 1.2; 3.4 appeared later and were identified on relatively resistant varieties Kenya Baraka, Br-112-113, and others.

In 1983 assessment of race composition of Ph. infestans was also conducted: samples were collected from three different sites: Ambo, Holetta, Bako.

Race 1; 3.4; 4.7; 8; 10; 11; 14 were identified on different potato varieties at the SPL experimental field: B-6334; Br-114-34; Br-112-93; Spunta; Kenya Baraka; R-547-73; Br-112-113; R-88-64; Br-114-26.

Race 1.2; 3.4; 8; 10; 11 were identified from the samples collected at Holetta on Spunta (AL-135); AL-624; AL-421. Race 8; 10; 11 were also identified from the samples collected at Bako on variety Br-102-52 (AL-549); Con 69-1(AL-252). Race 8; 10; 11 were prevalent races all the three cites. Unlike cropping season 1982, race 1 was identified early cropping season of 1983.

Fungicide trial against late blight of potato.

Six fungicides were tested for their effectiveness against late blight of potato Ridomil, Kocide-101, Mancozeb, Diafolatan, Anthracol, and Perenax.

Ridomil (3 kg/ha), Diafolatan (0.4%) and Mancozeb (3kg/ha) were effective on the susceptible variety - Local. The fungicides reduced late blight development from 25 to 75% using 6 times application in 8 days interval. Relatively high yields were obtained due to the effect of fungicides as compared to the control (table 4.).

Table 4. Results of fungicide trial (1982-83)

Fungicides	1982					1983				
	Yield	Late blight progress, %				Yield	Late blight progress, %			
	Q/ha	7. 08	15. 08	25. 08	13. 09	Q/ha	16. 07	27. 07	4. 08	17. 08
1. Anthracol	126	56	62	73	81	83	37	46	50	70
2. Kocide-101	135	64	66	72	79	75	34	40	44	63
3. Mancozeb	143	56	62	65	68	115	38	40	50	68
4. Diafolatan	146	65	66	70	73	165	36	39	42	65
5. Ridomil MZ 63.5	210	28	31	32	32	310	28	19	9	3
6. Perenax	-	-	-	-	-	99	30	42	48	65
7. Control	96	70	81	86	96	81	38	59	71	90
LSD_{05}	38.9					LSD_{05}	37.4			

Assessment of losses due to late blight of potato.

The trial was conducted on four varieties which has got different degree of resistance: Spunta, Kenya Baraka, Br-112-93 and Local using natural infection background. Ridomil Mz 63.5 (3kg/ha) was used 6 times application in 8 days interval for the protected treatment (table 5.).

Table 5. Actual yield loss in relation to disease intensity.

Variety	Treatment	1982 Yield Q/ha	1982 Actual yield loss %	1982 Late blight progress %	1983 Yield Q/ha	1983 Actual yield loss %	1983 Late blight progress % 10.08	1983 Late blight progress % 22.08
Spunta	P	530	3.2	0	630.4	45.8	0	0
	NP	548		0	463.3		64	93
Kenya Baraka	P	475	13.8	3.8	535.3	26.5	0	0
	NP	408.4		19.6	289.9		21	33
Br-112-92	P				642.7	80.7	0	12
	NP				124.0		89	100
Local	P	124	45.1	15.2	288.0	67.9	4	5
	NP	68		90.6	92.3		75	96

P - protected; NP - non protected

Potato seed treatment trial against late blight of potato

The trial was conducted on different potato varieties: Anita, Spunta, Kenya Baraka and Local. Ridomil 0.5 kg/t was used for treating blight infected potato tubers. Difference (increment) of yield was obtained from Ridomil-treated tubers of each varieties as compared with the non-treated (table 6).

Table 5. Results of potato seed treatment trial.

Variety	Treatment	Yield q/ha	% yield increase	Late blight progress, %		
				6.08	14.08	22.08
Anita	T	496.1	25.3	0	0	0
	NT	370.4		0	0	0
Spunta	T	269.2	16.8	10.0	52.7	92.3
	NT	224.1		23.7	63.8	98.4
Kenya Baraka	T	516.3	42.1	0	8.3	9.3
	NT	299.3		0	26.4	44.4
Br-114-34	T	515.2	31.0	0	8.9	30.5
	NT	358.0		6.7	13.3	39.0
Local	T	224.6	42.4	62.7	69.4	87.4
	NT	139.4		71.6	74.9	93.2

T - Ridomil treated; NT - non treated

Use of meristem culture method for eradication of virus diseases in potato.

Meristem culture method for eradication of virus diseases was conducted on different potato varieties and clones. Three potato clones are transfered to pots: - Spunta (AL-135); Anita (AL-148); Br-114-121 (AL-578).
Six potato clones are on maintenance and multiplication process in the test tubes: - BR-112-113 (AL-624); Br-112-42 (AL-601); Anita (AL-148); Kenya Baraka (AL-100), Spunta (AL-135); and AL-518.
Meristem tip excision was don on Anita (AL-148) and Spunta (AL-135). Some virus symptoms were observed on varieties planted for the second year in the field for increase: - Br-112-42 (AL-601); Br-112-113 (AL-624); Cex-69-1 (AL-253); Anita (AL-204); AL-417; AL-582. As a result, infected plants were rouged and healthy plants of each variety are now maintained in the store for the next season.

Maintenance of foundation potato seeds.

Maintenance of foundation potato seeds were carried out for different varieties: Kenya Baraka, Spunta, Diamant, Cardinal and Ramenski. Potato seeds of each variety were planted in the field and mass selection was conducted. Samples were taken at random from each variety to determine the quality of the seeds using "ELISA" method. Healthy plants with medium tuber size were harvested and stored:

Kenya Baraka	27 q,	Spunta	8 q,
Diamant	3 q,	Cardinal	2,5 q,
Ramenski	0.8 q.		

The "ELISA" method was also used for checking virus diseases of meristem cleaned potato varieties (table 7).

Table 7. Results of identification of virus and bacteria using "ELISA" method.

	Virus						Bacteria	
	PVX	PVY	PVS	PVA	PVM	PLRV	Erwinia carato-vora	Coryno-bacteri-um sepe-denicum
1. Kenya Baraka	+	-	-	-	-	-	-	-
2. Spunta	+	-	+	-	-	-	-	-
3. Diamant	-	-	-	-	-	-	-	-
4. Cardinal	-	-	-	-	-	-	-	-
5. Ramenski	-	-	-	-	-	-	-	-
6. Br-112-42	-	-	-	-	-	-	-	-
7. Cebeco	-	-	+	-	-	-	-	-
8. B-5504	-	-	+	-	-	-	-	-
9. Br-112-113	-	-	-	-	-	-	-	-
10. P-9	+	-	-	-	-	-	-	-
11. IND-73	-	-	-	-	-	-	-	-
12. R-28-86	-	-	-	-	+	-	-	+

+ - positive reaction to the respective type of virus and bacteria;
- - negative reaction to the respective type of virus and bacteria.

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