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INFLUENCE OF PHYTOSANITARY TREATMENTS ON LATE BLIGHT (*Phytophthora infestans*) CONTROL AND POTATO YIELD UNDER THE AGRO-CLIMATIC CONDITIONS OF SUCEAVA

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Abstract. *The research was conducted in Suceava (Romania) during the 2023 growing season and aimed to evaluate the interaction between phytosanitary treatment regimes and genotype response in potato (Solanum tuberosum L.) under late blight (Phytophthora infestans) pressure. Four commercial cultivars (Darilena, Red Lady, Riviera, Temerar) were tested in a 4 × 5 factorial experiment with five treatment schemes applied according to crop phenophases (BBCH 35–55), including systemic, systemic-contact, contact-only programs, and an untreated control. Climatic analysis based on decadal records showed alternating periods of moderate temperature (15–22°C) and high relative humidity (>80%), particularly in June and early July, creating favorable infection conditions. Yield was determined at harvest and fractionated into commercial size classes. ANOVA results indicated no significant treatment influence on the smallest tuber fraction (<30 mm), a moderate linear trend for medium-sized tubers (30–55 mm), and a strong significant positive effect of intensive treatments on the largest fraction (>55 mm). Cluster analysis grouped the genotype–treatment combinations into three clusters, reflecting distinct yield structuring under disease pressure. Temerar and Riviera exhibited the highest stability and partial resistance, Red Lady showed intermediate behavior, while Darilena was highly sensitive, with its highest yield obtained even in the untreated variant, suggesting intrinsic but limited resistance expression. The findings demonstrate that phytosanitary strategy and cultivar selection must be jointly optimized to ensure stable marketable yield in temperate-humid potato production systems.*

Keywords*: potato, late blight, phytosanitary treatments, yield, genotype response*

INTRODUCTION

Potato (*Solanum tuberosum* L.) remains a strategic food crop worldwide, ranking fourth after wheat, rice, and maize in terms of consumption and production (FAO, 2023). Cultivated in diverse agro-ecological zones, it represents a key source of carbohydrates, vitamins and economic value for both industrial and household food systems. In Romania, potato production is traditionally associated with hilly and mountainous regions, where climatic conditions favor good yield potential, but also increase vulnerability to foliar diseases, particularly late blight caused by *Phytophthora infestans* (Mont.) de Bary (FRY, 2008; COOKE Et Al., 2012; NOWICKI Et Al., 2012).

Late blight remains one of the most destructive diseases of potato worldwide, capable of causing epidemics that result in severe foliage damage, tuber infection, and yield losses exceeding 70% under favorable climatic conditions (SKELSEY ET AL., 2009; HAVERKORT ET AL., 2016; GONZÁLEZ-JIMÉNEZ ET AL., 2023). The pathogen demonstrates high evolutionary plasticity and rapid adaptation to host resistance genes and fungicide pressure, leading to recurrent emergence of novel, more aggressive clonal lineages (HANSEN ET AL., 2015; SAVILLE ET AL., 2015; FORBES ET AL., 2020). Optimal conditions for infection and epidemic spread include temperatures between 15–22°C and prolonged leaf wetness or high relative

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humidity, conditions which frequently occur in temperate-continental climates (KRAUSE & MASSIE, 1983; SKELSEY Et Al., 2009).

Genetic resistance to *P. infestans* is quantitatively inherited and influenced by crop phenology, canopy architecture, and physiological traits such as leaf structure and photosynthetic duration (LEHSTEN Et Al., 2017; KIM Et Al., 2022). Recent studies highlight that cultivar maturity class and canopy development play a critical role in disease severity and yield stability (LI Et Al., 2021; WU Et Al., 2024). Therefore, integrating cultivar resistance with fungicide-based management remains a cornerstone of late blight control under field conditions.

Modern fungicide programs commonly alternate systemic and contact modes of action to ensure both curative and preventive protection, reducing disease progression and area under disease progress curve (AUDPC) (González-Jiménez Et Al., 2023; Reddy Et Al., 2023). Active ingredients such as oxathiapiprolin, mandipropamid and fluopicolid have been shown to provide improved protection efficiency and longer-lasting activity compared to older chemistries (YANG Et Al., 2023; HOSSAIN Et Al., 2024). However, treatment efficacy is strongly dependent on application timing relative to crop phenology and infection risk periods (BURDON & FRAAIJE, 2020; COOKE Et Al., 2023).

In the temperate-humid agro-climatic conditions of Suceava County, seasonal fluctuation in rainfall and temperature often coincides with critical potato growth phases, enhancing late blight infection potential. Therefore, evaluating cultivar behavior and fungicide program performance under local conditions is essential for developing effective, sustainable disease management strategies.

The present study aims to assess the influence of phytosanitary treatment schemes on late blight control and yield performance in four commercial potato cultivars under field conditions in Suceava. Specifically, the objectives were: to analyze genotype × treatment interactions in relation to disease pressure, to evaluate total and marketable yield responses, and to examine tuber size distribution as a determinant of commercial quality.

MATERIAL AND METHODS

The research was carried out at the Agricultural Research and Development Station Suceava in 2023, under field conditions, during a growing period extending from April 28 (planting) to September 28 (harvest). The biological material consisted of four potato genotypes, designated as factor A: A1 – Darilena, A2 – Red Lady, A3 – Riviera, and A4 – Temerar. Factor B included five differentiated phytosanitary treatment schemes, applied according to crop phenological stages:

- B1 (BBCH 35–39) – preventive systemic treatments applied at 10-day intervals during canopy closure, aimed at blocking latent infections;
- B2 (BBCH 50–55) – systemic or systemic-contact treatments applied weekly at the onset of first symptoms, to limit epidemic development;
- B3 (BBCH 40–49) – systemic + contact treatments applied every 10 days during active tuberization, to prevent secondary infections;
- B4 (BBCH 40–49) – contact treatments applied weekly under high infection pressure;
- B5 – untreated control, used to assess disease severity and production losses in the absence of crop protection.

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The experiment followed a 4 × 5 factorial design, arranged in two replications, according to the randomized block method. Each experimental plot covered 24 m², and the total area per replication was 480 m².

The soil at the experimental site is classified as a cambic phaeozem, with slightly acidic reaction (pH 5.8), humus content of 3.68%, available phosphorus (PAL) of 32 ppm and available potassium (KAL) of 91 ppm, with a base saturation of 17.11 me/100 g soil. Soil texture ranged from medium clay loam to clay-sandy loam, characterized by medium to high fertility and favorable water retention capacity.

Climatic conditions were analyzed by decades, using local meteorological data. Temperatures increased progressively from 8–12°C at planting to 20–23°C in July–August, then decreased gradually in September. Precipitation showed a non-uniform distribution, with heavier rainfall episodes in June and August (18–50 mm/decade) and high relative humidity (65–80%), conditions which favored foliar disease development during the BBCH 35–55 interval.

At harvest, total yield was determined by weighing and subsequently fractionated into size classes according to tuber diameter: <30 mm, 30–55 mm, and >55 mm, with results expressed in t/ha. This approach allowed the assessment of both yield potential and commercial yield structure.

Statistical analysis was performed using factorial ANOVA (A × B), and differences among treatments were evaluated using the LSD test at $p \leq 0.05$. To identify variation trends according to treatment intensity, linear trend components were also examined. Additionally, hierarchical cluster analysis was applied to evaluate similarities among variants based on yield structure, using Euclidean distance and the complete linkage method, with results represented as dendrograms.

RESULTS AND DISCUSSIONS

Climatic conditions and disease pressure

Decadal climatic data revealed progressively increasing air temperatures from planting (8–12°C) to peak summer values of 20–23°C, followed by a gradual decline in September. Relative humidity fluctuated between 55% and 80%, with sustained high values (>70%) recorded during June and early July, coinciding with dense canopy formation (BBCH 35–55). Precipitation showed a non-uniform distribution, with notable rainfall peaks in May I, June III and August I (figure 1).

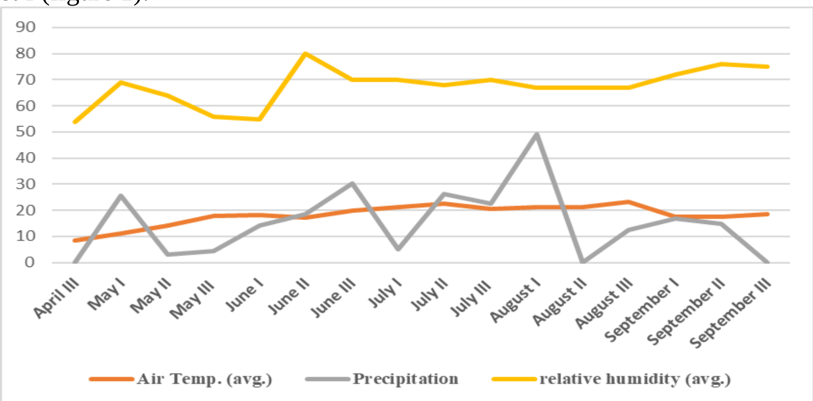

Figure 1. Decadal climatic evolution during the potato growing season in Suceava, 2023

These intervals of moderate temperature (15–22°C) combined with elevated humidity created favorable infection windows for *Phytophthora infestans*, supporting both primary and secondary infection cycles. Such climatic dynamics align with late blight epidemic patterns commonly reported in temperate-continental potato-growing regions.

Total yield variation across genotypes and treatment schemes

Table 1

Total tuber yield (t/ha) as influenced by genotype and phytosanitary treatment scheme

Genotype	Treatment scheme	Fraction	Production t/ha	Procent %	Total t/ha
Darilena	B1	30-55	7,35	38,15	19,3
Darilena	B1	<30	4,2	21,7	19,3
Darilena	B1	>55	7,75	40,1	19,3
Darilena	B2	30-55	6,95	39,15	17,7
Darilena	B2	<30	3,65	20,7	17,7
Darilena	B2	>55	7,1	40,15	17,7
Darilena	B3	30-55	6,5	34,65	18,75
Darilena	B3	<30	5,2	27,7	18,75
Darilena	B3	>55	7,05	37,6	18,75
Darilena	B4	30-55	6,65	37,9	17,55
Darilena	B4	<30	4,55	25,95	17,55
Darilena	B4	>55	6,35	36,2	17,55
Darilena	B5	30-55	5,3	38,3	13,85
Darilena	B5	<30	6,15	44,3	13,85
Darilena	B5	>55	2,4	17,4	13,85
Red Lady	B1	30-55	6,55	30,35	21,65
Red Lady	B1	<30	5,8	26,8	21,65
Red Lady	B1	>55	9,3	42,85	21,65
Red Lady	B2	30-55	7	34,6	20,25
Red Lady	B2	<30	6,25	30,85	20,25
Red Lady	B2	>55	7	34,55	20,25
Red Lady	B3	30-55	6,05	31,85	19
Red Lady	B3	<30	5,25	27,6	19
Red Lady	B3	>55	7,7	40,55	19
Red Lady	B4	30-55	6,95	37,45	18,55
Red Lady	B4	<30	4,5	24,25	18,55
Red Lady	B4	>55	7,1	38,3	18,55
Red Lady	B5	30-55	5,85	32,05	18,25
Genotype	**Treatment scheme**	**Fraction**	**Production t/ha**	**Procent %**	**Total t/ha**

Red Lady	B5	<30	5,85	32,1	18,25
Red Lady	B5	>55	6,55	35,9	18,25
Riviera	B1	30-55	9,9	49,05	20,15
Riviera	B1	<30	2	10	20,15
Riviera	B1	>55	8,25	40,95	20,15
Riviera	B2	30-55	8,2	42,7	19,2
Riviera	B2	<30	2,2	11,45	19,2
Riviera	B2	>55	8,8	45,8	19,2
Riviera	B3	30-55	8,1	41,6	19,45
Riviera	B3	<30	4	20,6	19,45
Riviera	B3	>55	7,35	37,8	19,45
Riviera	B4	30-55	7,55	39,95	18,9
Riviera	B4	<30	4,55	24,05	18,9
Riviera	B4	>55	6,8	36	18,9
Riviera	B5	30-55	6,9	40,2	17,15
Riviera	B5	<30	3,9	22,8	17,15
Riviera	B5	>55	6,35	37	17,15
Temerar	B1	30-55	7,15	31,9	22,4
Temerar	B1	<30	6,6	29,45	22,4
Temerar	B1	>55	8,65	38,65	22,4
Temerar	B2	30-55	6,2	31,15	19,9
Temerar	B2	<30	6,4	32,15	19,9
Temerar	B2	>55	7,3	36,65	19,9
Temerar	B3	30-55	7,85	37,5	20,95
Temerar	B3	<30	5,45	26,05	20,95
Temerar	B3	>55	7,65	36,5	20,95
Temerar	B4	30-55	7,45	36,8	20,25
Temerar	B4	<30	5	24,7	20,25
Temerar	B4	>55	7,8	38,5	20,25
Temerar	B5	30-55	5,75	31,1	18,5
Temerar	B5	<30	6,45	34,9	18,5
Temerar	B5	>55	6,3	34,05	18,5

The results presented in Table 1 show clear differences among treatment schemes and genotypes with respect to total yield. Preventive systemic treatments (B1), as well as systemic-to-systemic contact programs (B2 and B3), ensured the highest yield levels, ranging between 19.9 and 22.4 t/ha depending on genotype. Treatments based solely on contact fungicides (B4)

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maintained intermediate performance, whereas the untreated control (B5) consistently resulted in reduced yield across all cultivars, confirming the strong influence of late blight pressure during the 2023 season.

Among cultivars, Temerar recorded the highest and most stable yields (22.4–20.2 t/ha under B1–B4), with only a moderate decline under the untreated control (18.5 t/ha). This indicates good field tolerance and sustained canopy function under infection pressure. Riviera similarly exhibited a stable yield profile (20.1–17.1 t/ha), suggesting robust adaptive behavior under varying protection intensity. Red Lady showed an intermediate response, with relatively balanced yields across treatments (21.6–18.2 t/ha), indicative of moderate tolerance. In contrast, Darilena presented the highest susceptibility, reflected by a pronounced reduction in total yield under B5 (13.85 t/ha compared to 19.3 t/ha under B1).

Overall, these results emphasize that cultivar choice remains a decisive factor in achieving yield stability under late blight pressure. Furthermore, systemic or systemic–contact fungicide programs are essential for maintaining commercial yield potential in years when climatic conditions favor *Phytophthora infestans* infection and epidemic development.

Yield structure by tuber size classes

These yield dynamics highlight the combined influence of genotype and fungicide strategy under late blight pressure. However, total yield alone does not fully reflect production value, since marketability in potato is strongly determined by the distribution of tubers across commercial size categories. For this reason, the harvested yield was subsequently fractionated into diameter classes, in order to assess not only how much was produced, but also how the application of different treatment schemes affected the structure and quality of the marketable yield. This approach allowed a clearer understanding of whether the phytosanitary programs favored the formation of larger, commercially preferred tubers or, conversely, resulted in a higher proportion of small, less valuable fractions.

Table 2

Fractionated tuber yield (t/ha) by size class in relation to genotype and treatment scheme

Yield (t/ha)			Mean Difference (I-J)	Std. Error	Sig.
Diameter of Tubers <30mm	1B	2B	-.50000	1.03192	.635
		3B	-.52500	.94788	.588
		4B	-.20000	.94788	.836
		5B	-1.13750	.94788	.249
	2B	1B	.50000	1.03192	.635
		3B	-.02500	1.07921	.982
		4B	.30000	1.07921	.785
		5B	-.63750	1.07921	.564
	3B	1B	.52500	.94788	.588
		2B	.02500	1.07921	.982

		4B	.32500	.99916	.749
		5B	-.61250	.99916	.549
	4B	1B	.20000	.94788	.836
		2B	-.30000	1.07921	.785
		3B	-.32500	.99916	.749
		5B	-.93750	.99916	.363
	5B	1B	1.13750	.94788	.249
		2B	.63750	1.07921	.564
		3B	.61250	.99916	.549
		4B	.93750	.99916	.363
Diameter of Tubers 30-55 mm	1B	2B	.44667	.70660	.537
		3B	.45500	.64905	.494
		4B	.43000	.64905	.518
		5B	1,63000*	.64905	.024
	2B	1B	-.44667	.70660	.537
		3B	.00833	.73898	.991
		4B	-.01667	.73898	.982
		5B	1.18333	.73898	.130
	3B	1B	-.45500	.64905	.494
		2B	-.00833	.73898	.991
		4B	-.02500	.68416	.971
		5B	1.17500	.68416	.106
	4B	1B	-.43000	.64905	.518
		2B	.01667	.73898	.982
		3B	.02500	.68416	.971
		5B	1.20000	.68416	.100
	5B	1B	-1,63000*	.64905	.024
		2B	-1.18333	.73898	.130
		3B	-1.17500	.68416	.106
		4B	-1.20000	.68416	.100
Diameter of Tubers >55mm	1B	2B	.51000	.80235	.535
		3B	.77250	.73700	.311
		4B	1.19750	.73700	.125
		5B	2,81000*	.73700	.002
	2B	1B	-.51000	.80235	.535

	3B	.26250	.83911	.759
	4B	.68750	.83911	.425
	5B	2,30000*	.83911	.015
3B	1B	-.77250	.73700	.311
	2B	-.26250	.83911	.759
	4B	.42500	.77687	.592
	5B	2,03750*	.77687	.019
4B	1B	-1.19750	.73700	.125
	2B	-.68750	.83911	.425
	3B	-.42500	.77687	.592
	5B	1.61250	.77687	.056
5B	1B	-2,81000*	.73700	**.002**
	2B	-2,30000*	.83911	.015
	3B	-2,03750*	.77687	.019
	4B	-1.61250	.77687	.056

Cluster analysis of genotype–treatment associations

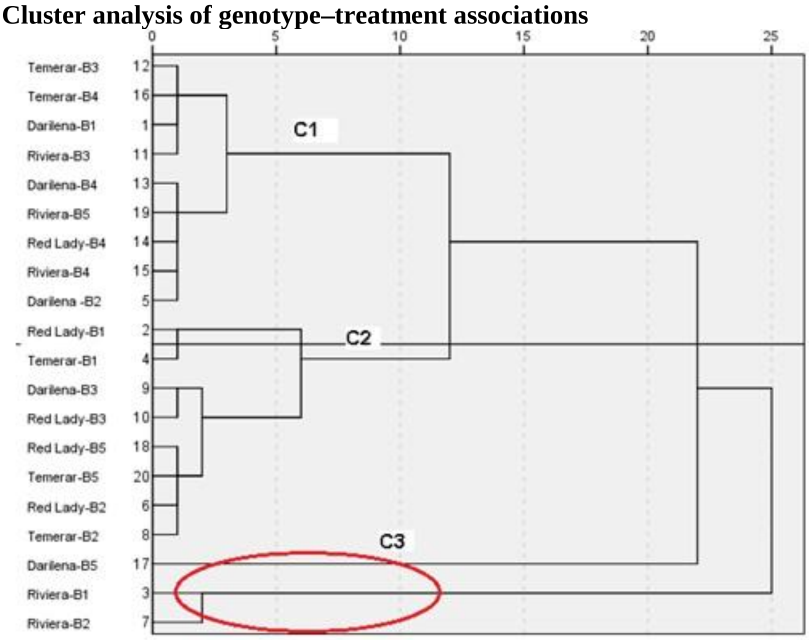

Figure 2. Hierarchical cluster analysis of genotype × treatment combinations based on yield structure.

The hierarchical cluster analysis based on Ward's linkage method (figure 2) grouped the genotype–treatment combinations into three distinct clusters, reflecting differences in yield structure and tuber size distribution under late blight pressure.

Cluster C1 was the largest and most compact group, comprising combinations that produced balanced yield distributions across tuber size fractions, with moderate sensitivity to disease pressure and relatively stable responses to treatment. This cluster included the following genotype–treatment pairs: *Temerar-B3, Temerar-B4, Darilena-B1, Riviera-B3, Darilena-B4, Riviera-B5, Red Lady-B4, Riviera-B4*, and *Darilena-B2*. The close grouping indicates similar production profiles, where treatments ensured maintenance of canopy integrity without leading to substantial yield divergence. The presence of both preventive and curative schemes in this cluster suggests that these genotypes showed consistent response patterns regardless of treatment intensity.

Cluster C2 included combinations associated with higher total yield levels and improved marketable tuber fractions, though without reaching the extremes observed in the most intensively treated variants. This cluster consisted predominantly of *Red Lady* and *Temerar* responses: *Red Lady-B1, Temerar-B1, Darilena-B3, Red Lady-B3, Red Lady-B5, Temerar-B5, Red Lady-B2*, and *Temerar-B2*. These variants displayed intermediate stability, suggesting that *Red Lady* and *Temerar* show better compensation capacity under variable disease pressure, likely due to better canopy retention. The separation from Cluster C1 indicates increased treatment responsiveness, particularly in the formation of commercial tuber classes.

Cluster C3, which included *Darilena-B5, Riviera-B1*, and *Riviera-B2*, represented the most contrasting group, characterized by reduced yield stability and marked shifts toward smaller tuber fractions. The untreated variant *Darilena-B5* highlights the cultivar's high susceptibility to late blight when no protection is applied. The grouping of *Riviera-B1* and *Riviera-B2* in the same cluster indicates that *Riviera* does not possess intrinsic resistance, but rather maintains productivity only under appropriately timed fungicide programs. When preventive or well-synchronized applications are lacking, a rapid decline in yield and commercial tuber size occurs. This emphasizes the importance of fungicide timing and intensity, particularly under epidemic conditions.

The cluster analysis confirms that yield stability and tuber size distribution are jointly influenced by genotype and treatment intensity. Temerar and Red Lady showed the most consistent performance across treatment schemes, particularly under systemic or systemic–contact protection. Riviera maintained productivity only when fungicide timing matched disease development stages, while Darilena experienced pronounced yield loss in the absence of protection, reflecting high susceptibility to late blight.

Overall, the clustering supports the yield and ANOVA results, emphasizing that integrating cultivar selection with preventive or well-timed fungicide strategies is essential under the temperate-humid conditions of Suceava, where late blight pressure is recurrent and climate-driven.

CONCLUSIONS

The results of this study highlight the integrated influence of genotype and phytosanitary treatment strategy on potato yield performance under late blight pressure in the agro-climatic conditions of Suceava. Preventive systemic and systemic–contact fungicide programs (B1–B3) were the most effective in maintaining total yield and commercial tuber size structure, while contact-only protection (B4) ensured only partial control. The untreated control

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(B5) consistently resulted in yield reduction and a shift toward smaller tuber fractions, confirming the epidemiological severity of the 2023 season.

Among the tested cultivars, Temerar demonstrated the highest field tolerance and yield stability across treatment intensities, while Riviera maintained stable performance only when fungicide timing matched critical infection periods. Red Lady displayed intermediate adaptability, whereas Darilena showed the highest susceptibility, particularly under the absence of protection.

Fractionated yield data showed that fungicide treatments did not influence the formation of small tubers (<30 mm), but significantly affected the proportion of marketable and large tubers. Increasing treatment intensity shifted production toward the >55 mm fraction, emphasizing the role of canopy protection in supporting tuber bulking. The hierarchical cluster analysis further confirmed these patterns, grouping genotype–treatment combinations according to yield stability and commercial quality response.

Overall, the study demonstrates that optimal disease management under late blight pressure requires a combined approach, where the selection of disease-tolerant cultivars must be paired with well-timed systemic or systemic–contact fungicide programs to ensure both yield preservation and commercial quality.

BIBLIOGRAPHY

BURDON, J., FRAAIJE, B. (2020). Fungicide timing and disease forecasting in potato. *Plant Disease Management Reports*, 14(2): 233–241.

COOKE, D.E.L., LEES, A., TURNBULL, D., COOKE, L. (2012). Phytophthora infestans: a global pathogen. *Molecular Plant Pathology*, 13(11): 109–122.

COOKE, D.E.L., PÉREZ, W., SHARPE, A. (2023). Advances in integrated late blight management. *Annual Review of Phytopathology*, 61: 347–372.

FAO (2023). *FAOSTAT Statistical Database*. Food and Agriculture Organization of the United Nations.

FORBES, G., PEREA, S., GIL, F. (2020). Epidemiological shifts in late blight populations. *Plant Pathology*, 69(7): 1235–1247.

FRY, W. (2008). Phytophthora infestans: the plant destroyer. *Molecular Plant Pathology*, 9(3): 385–402.

GONZÁLEZ-JIMÉNEZ, J., PÉREZ, W., GUTIÉRREZ, S., ET AL. (2023). Late blight management under high disease pressure. *Crop Protection*, 167: 106–188.

HANSEN, Z., EVERETT, K., TRACY, S. (2015). Recent evolution of aggressive clonal lineages of Phytophthora infestans. *Plant Disease*, 99(10): 1484–1490.

HAVERKORT, A., BOONE, K., TIJINK, F., ET AL. (2016). Late blight and global potato production. *Potato Research*, 59: 359–393.

HOSSAIN, M., AHMED, S., LI, Q. (2024). Fluopicolid and mandipropamid activity against Phytophthora infestans. *Pesticide Biochemistry and Physiology*, 195: 105–448.

KIM, H., KIM, J., LEE, S., ET AL. (2022). Canopy traits influencing late blight progression. *Frontiers in Plant Science*, 13: 874502.

KRAUSE, R.A., MASSIE, L.B. (1983). Predictive models for late blight development. *Phytopathology*, 73: 1164–1168.

LEHSTEN, V., SCHAUB, B., PLOCH, T., ET AL. (2017). Potato genotype architecture and blight tolerance. *Agricultural and Forest Meteorology*, 247: 158–168.

LI, Y., ZHAO, T., LIU, D. (2021). Maturity classes and late blight resistance in potato germplasm. *Euphytica*, 217: 118.

NOWICKI, M., LATERROT, H., CHARKOWSKI, A., FRY, W. (2012). Potato and late blight – what we know and what we need to know. *Plant Disease*, 96: 1177–1189.

REDDY, P., THIRUNAVUKKARASU, A., KUMAR, K. (2023). Performance of systemic fungicides against late blight. *International Journal of Plant Protection*, 17(3): 211–219.

http://doi.org/10.59463/RJAS.2025.3.33

SAVILLE, A., GRAHAM, K., GRÜNWALD, N. (2015). Population genomics of Phytophthora infestans. *Phytopathology*, 105(10): 1373–1385.

SKELSEY, P., ROSS, D., FALLOON, P., RITCHIE, S. (2009). Impact of climate variability on Phytophthora infestans infection periods. *Plant Pathology*, 58: 1–11.

WU, X., LIU, C., REN, T. (2024). Physiological determinants of blight resistance in potato. *Journal of Plant Physiology*, 295: 154–216.

YANG, L., WANG, Y., HU, X. (2023). Efficacy of oxathiapiprolin-based fungicides for late blight control. *Crop Protection*, 164: 106–152.