

Weed Flora Analysis In Conventional Potato Crop In Țara Bârsei Area

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Abstract. The damages caused by weeds do not only results in potato yield reduction but also in the tubers quality, reducing tuber size, affecting starch and protein content, and increase the likelihood of physiological disorders. Floristic weed analysis was carried out during 2023-2024 in the experimental plots of NIRDPSB Brasov. Weed flora consisted of 19 species; the most frequent species were *Convolvulus arvensis* L., *Cirsium arvense* (L.) Scop., *Chenopodium album* L., *Amaranthus retroflexus* L., *Setaria viridis* L. and *Equisetum arvense* L. Weed seeds reach maturity, depending on the species, at very different times, practically throughout the entire vegetation period. Given the very large number of weeds, knowledge of the diversity is a condition for establishing an effective system of control measures that will ensure the avoidance of seed formation and shedding. The most represented families were: Asteraceae (4 species), Poaceae and Polygonaceae (3 species each), Lamiaceae and Brassicaceae (2 species each), while rest families (Rubiaceae, Chenopodiaceae, Equisetaceae, Amarathaceae, Convolvulaceae) were represented by one species. The weed threshold can be reduced to a reasonable and tolerant level using appropriate chemical control measures and knowing the weed flora composition.

Keywords: potato, species, weed family, weed flora

INTRODUCTION

The potato could be a major component in strategies to provide food for the poor and hungry, producing nutritious food quickly, on less land, in harsher climatic conditions than other major crops – over 85% of the plant is edible compared to 50% for cereals.

Weeds are considered to be the most harmful to agricultural production; besides affecting agrobiodiversity, they indirectly affect the crop production, by competing with the crops for resources, protecting crop pests, reducing yield and quality, and consequently increasing processing costs (Zimdah, 2013; Meseldžija et al., 2020). Initial weed competition can decrease yield, while competition at the end of crop cycle, such as the one exert by pigweed (*Amaranthus quitensis*), common lambsquarter, Bermuda Grass (*Cynodon dactylon*) and field binweed (*Convolvulus arvensis*) could not only reduce yield but could also interfere with harvest operations (Caldiz et al., 2016).

Weed establishment is favored at the beginning of a crop cycle, especially from planting time to hilling and the closing of the canopy, because of exposed soil, frequent irrigation and the early stage of potato crop development.

Weed should be controlled until the crop sufficiently covers the soil surface and is not subject to further interference (Silva et al., 2011; Luz et al., 2018)

According to Nikolić et al. (2013) who cited specialized literature (Bound and Grundy, 2001; Boguzas et al., 2004) the weed flora plays a significant role in the overall biodiversity and the functioning of these anthropogenic ecosystems, their optimal operation still requires maintaining a correct balance between cultivated and wild plants, as weeds contribute to better regulation of environmental conditions.

Weeds are a major problem in potatoes crop in Romania. Large distance between rows, the use of manure and fertilizers, the long period from planting to plant emergence, slow preliminary growth of potato plants create favourable conditions for an early emergence (Soren et al., 2018; Cristea et al., 2022).

Integrated weed management practices, including crop rotation, mechanical cultivation and the rational use of herbicides, are increasingly promoted as sustainable approaches for maintaining potato productivity and reducing environmental impact (Harker and O'Donovan, 2013; Swanton et al., 2015). Moreover, climatic variability and changing agricultural practices may influence weed population dynamics and species composition in potato agroecosystems, making continuous monitoring of weed flora essential for the development of effective control strategies (Korres et al., 2016; Chauhan, 2020).

The aim of this study was to provide an overview of the weed flora in potato field in Țara Bârsei area, as well as a taxonomic and biological spectrum analysis. The weed threshold can be reduced to a reasonable and tolerant level using appropriate chemical control measures and knowing the weed flora composition.

MATERIAL AND METHODS

This study was conducted at the experimental field of Technology and good practices Department, NIRDPSB Brasov, Romania, during 2023-2024, on a cambic chernozem soil with 6.6 pH, humus 4.68% and clay 27%. The pre-crop in both years was wheat.

The biological material represented by Darilena, Romanian semi-early variety, with a vegetation period of 90-100 days, was planted manually in 2023, April 6 and in 2024, May 3. The technology applied was the classic one for potato cultivation, with basic plowing in autumn and then basic fertilization with NPK 15:15:15 in spring, planting and ridging the potato in the optimal period. Late blight and Colorado beetle control was done by applying treatments according to good agricultural practices. In the experiment no herbicides application was used.

Weeds determinations were conducted, using the metric frame (1 m²) recording the number of weeds and the observations were done on density (number of plants/m²), participation (% in which each species is involved in the whole weed infestation), frequency (% in which each species was found in the observation points), class (pteridophytes, monocotyledonous, dicotyledonous) and the life span of each species (ephemeral, annual, biennial, weeds that can overwinter, perennials) (Cristea et al., 2022).

RESULTS AND DISCUSSIONS

The most represented families were: Asteraceae (4 species), Poaceae and Polygonaceae were represented with 3 species each, Lamiaceae and Brassicaceae were represented by 2 species each, while rest families (Rubiaceae, Chenopodiaceae, Equisetaceae, Amaranthaceae, Convolvulaceae) were represented by one species. Among the species with large number of plants, the plants from Poaceae family participates to the infestation degree by an average of 29.2 %, the Asteraceae and Equisetaceae families by an average of 15.45% and Chenopodiaceae and Polygonaceae families by an average of 10%. A smaller number of plants were from Lamiaceae family by 6.36%, Brassicaceae family by 5.45%, by Amaranthaceae family 3.63%, by Rubiaceae family 2.73% and Convolvulaceae family by 1.82% (Table 1).

Table 1. Number of weeds species and their percentage distribution

Family	Number of species	%
Equisetaceae	1	15.45
Amaranthaceae	1	3.63
Chenopodiaceae	1	10.00
Polygonaceae	3	10.00
Brassicaceae	2	5.45
Convolvulaceae	1	1.82
Lamiaceae	2	6.36
Asteraceae	4	15.45
Poaceae	3	29.20
Rubiaceae	1	2.73
Total	19	100

The number of per species and per group (plants/m²), as well as the participation ratio (%) to the infestation degree depends on the weed.

Among annual weeds, the largest numbers of plants for one species were recorded for green foxtail (*Setaria viridis*) 25 plants/m², respectively 27 plants/m²; for redroot pigweed (*Amaranthus retroflexus*) 4 plants/m² respectively 5 plants/m²; for white goosefoot (*Chenopodium album*) 11 plants/m² respectively 8 plants/m². Also cleaver (*Galium aparine*) presented 3 plants/m², respectively 5 plants/m², the broadleaf henbit (*Lamium applexicaule*) recorded 5 plants/m², respectively 2 plants/m²; wild mustard (*Sinapis arvensis*) 4 plants/m², respectively 5 plants/m², common hemp-nettle (*Galeopsis tetrahit*) 2 plants/m², respectively 1 plants/m², shepherds purse (*Capsella bursa-pastoris*) 2 plants/m² and also 2 plants/m² in the next year. The annual dicotileous weeds from Polygonaceae family presented: 4 plants/m² for black bindweed (*Polygonum convolvulus*), 3 plants/m² for lady's thumb (*Polygonum persicaria*) in both years, 2 plants/m², respectively 4 plants/m² for pale smartweed (*Polygonum lapathifolium*).

Between the perennial dicotyledonous species, the following numbers were recorded: 17 plants/m² respectively 20 plants/m² for horsetail (*Equisetum arvense*), 4 plants/m² respectively 2 plants/m² for field thistle (*Cirsium arvense*); 2 plants/m² respectively 3 plants/m² for bindweed (*Convolvulus arvensis*); 8 plants/m²

respectively 9 plants/m² for sowthistle (*Sonchus arvensis*). The perennial monocotyledonous species presented: 3 plants/m², respectively 2 plants/m² for quackgrass (*Agropyron repens*) and 4 plants/m², respectively 2 plants/m² for couch grass (*Cynodon dactylon*). (Table 2 and Figure 1).

Table 2. Structure and number of weeds in potato untreated field recorded in 2023-2024 to NIRDPSB Brasov

	Family	Genus	Name of weed species	Weed count/m ²			
				2023	2024	Average 2023	Average 2024
1	Equisetaceae	Equisetum	<i>Equisetum arvense</i>	17	20	18.5	17.9
2	Amaranthaceae	Amaranthus	<i>Amaranthus retroflexus</i>	4	5	4.5	4.5
3	Chenopodiaceae	Chenopodium	<i>Chenopodium album</i>	11	8	9.5	7.2
4	Polygonaceae	Polygonum	<i>Polygonum convolvulus</i>	6	4	5.0	3.6
5			<i>Polygonum persicaria</i>	3	3	3.0	2.7
6			<i>Polygonum lapathifolium</i>	2	4	3.0	3.6
7	Brassicaceae	Capsella	<i>Capsella bursa-pastoris</i>	2	2	2.0	1.8
8		Sinapis	<i>Sinapis arvensis</i>	4	5	4.5	4.5
9	Convolvulaceae	Convolvulus	<i>Convolvulus arvensis</i>	2	3	2.5	2.7
10	Lamiaceae	Lamium	<i>Lamium amplexicaule</i>	5	2	3.5	1.8
11		Galeopsis	<i>Galeopsis tetrahit</i>	2	1	1.5	0.9
12	Asteraceae	Cirsium	<i>Cirsium arvense</i>	4	2	3.0	1.8
13		Galinsoga	<i>Galinsoga parviflora</i>	2	5	3.5	4.5
14		Senecio	<i>Senecio vulgaris</i>	3	3	3.0	2.7
15		Sonchus	<i>Sonchus arvensis</i>	8	9	8.5	8.0
16	Poaceae	Agropyrum	<i>Agropyron repens</i>	3	2	2.5	1.8
17		Cynodon	<i>Cynodon dactylon</i>	4	2	3.0	1.8
18		Setaria	<i>Setaria viridis</i>	25	27	26.0	24.1
19	Rubiaceae	Galium	<i>Galium aparine</i>	3	5	4.0	4.5
	Total			110	112	5.8	4.3



Figure 1. The presence of weeds in the potato field (Brasov, 2024)

Both 2023 and 2024 were exceptionally warm years and have impacted on weeds flora distribution and density (Figures 2 and 3). In 2023 growing season was warm but no so dry. The temperatures between May and August (18.2°C) was higher on average by 1.8°C, compared to MAA. The rainfalls in June and August exceeded the MAA as volume, but it must be stated that there were quantitatively significant rains in a short period of time. After a wet August a significant precipitation deficit was registered in September, only 11 mm compared to 65.6 mm.

In 2024, in May, the air temperature was at the level of the MAA, but the amount of precipitation was much lower than the MAA values, registering only 42.7 mm compared to 82 mm. The summer months (June-August) recorded higher temperatures than the MAA, with an average of 4.6°C higher in June. Also, the volume of precipitation was much lower in all three months, establishing the phenomena of atmospheric and pedological drought.

The sharp warming has fueled an increase in extreme weather events, including the intensification of heat waves, droughts, and heavy rainfall in a very short period of time. Some weeds may become more competitive under warmer, drier conditions, potentially outcompeting potato crops. High temperatures can trigger the germination of some weed seeds, leading to a surge in weed populations.

The distribution of weed species by botanical groups in potato crops in 2023 is shown in figure 2.

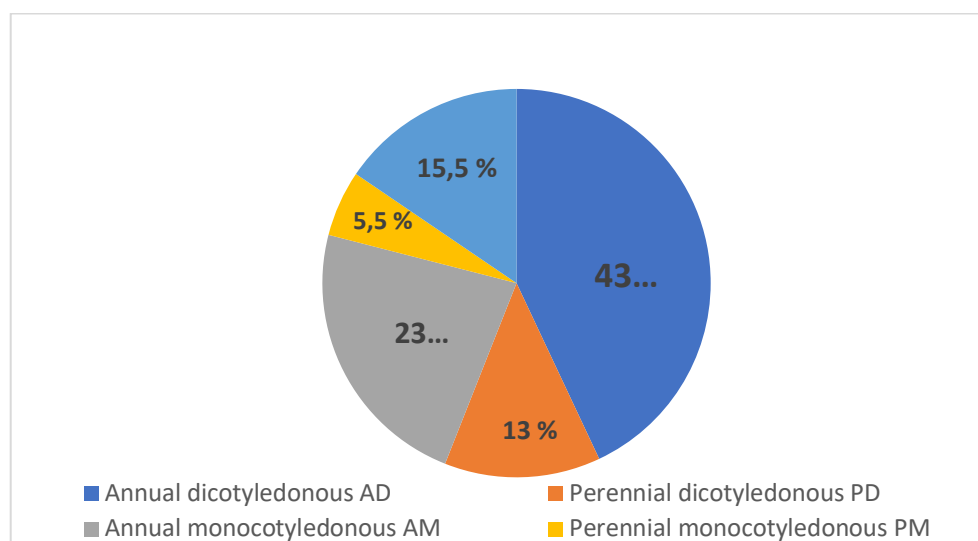


Figure 2. Weed species by botanical groups 2023

The distribution of weed species by botanical groups in potato crops in 2024 is shown in figure 3.

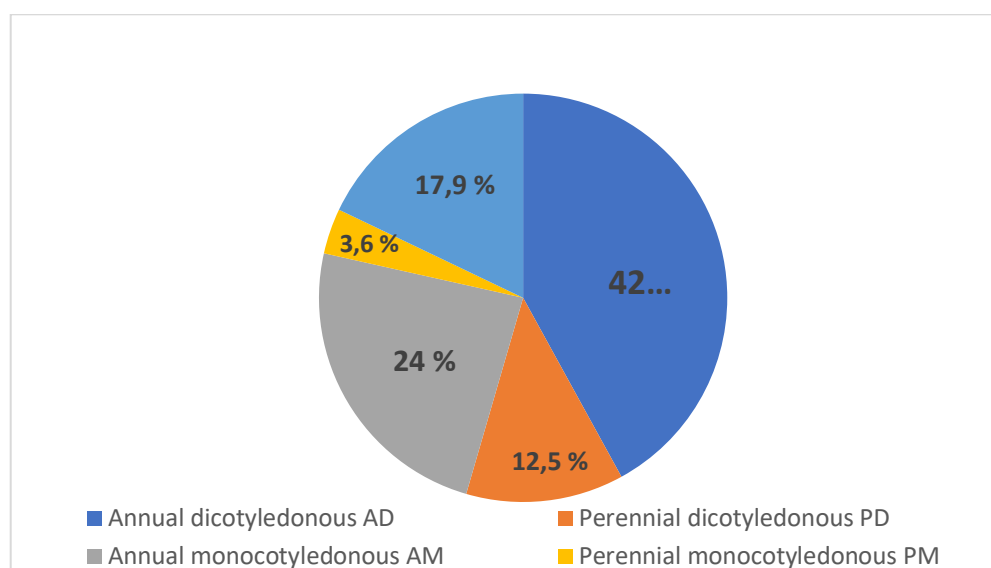


Figure 3. Weed species by botanical groups 2024

White goosefoot (*Chenopodium album*), redroot pigweed (*Amaranthus retroflexus*), field bindweed (*Convolvulus arvensis*) are drought resistant varieties, known for their ability to thrive under water-stressed conditions, making them particularly problematic in potato fields, especially in period with limited rainfall, as was the case in the studied years, 2023-2024.

Species like weeds from *Polygonum* family and *Galium aparine* (cleavers) can also be problematic, especially if they emerge before the potato canopy closes.

In potato crops, especially in Brasov area, *Equisetum arvense* (field horsetail) is considered a problematic weed due to its ability to spread through rhizomes and its resilience to control methods. It is also a plant that indicates soil acidity, which necessitates the application of calcareous amendments. For crops with rapid growth and high density, such as cereals, this weed does not present major competition, but in the case of crops with greater distances between

plants in a row and between rows, such as potatoes, it can contribute to suffocation of the crop. Field horsetail can tolerate long periods without rain because its rhizomes can extend several meters down into the soil. The buds on the rhizomes act as storage and regeneration organs, and can also disseminate the weed. Also *Setaria* (foxtail) pose significant problems competing for resources and impacting yield. The seeds can remain viable in the soil for up to two decades, meaning that infested fields can become sources of continued reinfestation. It is notable for its ability to spread massively in a short time and form compact clumps that suffocate the crop plant through competition for water and light.

We subscribe to what Kebede et al. (2016) observed during the studies undertaken, namely that different weed management methods can be used to suppress weeds, but physical and herbicidal methods are more frequently used for their control. The efficiency of a given chemical is limited only to controlling certain weed species and it can vary with the weed density, time of weed emergence, crop management practices, cropping system and the environmental conditions under which the crop is grown. Thus, it is important to conduct location specific experiments on weed management.

CONCLUSIONS

Structure of a weed flora is changes over time. The perennial forms are dominant and compete with potato plants. Dominant group of species is presented by *Setaria viridis*, *Equisetum arvense* and *Chenopodium album*.

The weed threshold can be reduced to a reasonable and tolerant level using appropriate chemical control measures and knowing the weed flora composition.

Also is important to understand that hot summer weather can impact on weeds, influencing their germination, growth, distribution, competitive ability, and response to the use of herbicides. Effective weed management strategies are needed to cope with changing climate conditions.

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