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INFESTATION MONITORING IN SWITCHGRASS AGROPHYTOCOENOSES

Shown is a comprehensive assessment of infestation in switchgrass crops under long-term growing in the Eastern Forest-Steppe of Ukraine. It was established that composition and total level of weed infestation in switchgrass crops is stipulated largely by its initial stand density and weather conditions during vegetation period.
Keywords: *switchgrass; plant stand density; weeds; hydrothermic factor (HTF)*

Introduction. Since 2008, switchgrass has been studied in Ukraine intensively as an alternative energy source. Meanwhile, switchgrass differs significantly from other cereal plants by its biological characteristics. Based on an investigation carried out at the Institute of Bioenergy Crops and Sugar Beet we established that soil and climate of the Eastern Forest-Steppe of Ukraine are favourable to the introduction of switchgrass [2].

In the first year of vegetation, switchgrass grows slowly and its seeds are weaker than weed ones. That is why weeds are one of the causes of its poor vegetation, and sometimes losses [1].

In the USA, switchgrass is grown mainly without the application of herbicides. However, in most cases switchgrass crops require weed control. Usually, there are so many weeds that it is difficult to distinguish plants of switchgrass among them. Thus, the recognition of switchgrass plants in a field was a very important point in application of herbicides against broadleaf weeds; therefore cutting is an effective measure to ensure the competitiveness of the crop [4, 5].

The adaptive ability of the crop determines prospects for its growing on eroded and reclaimed soils [3].

The objective of the study is to assess comprehensively switchgrass crops weediness under long-term growing in the Forest-Steppe of Ukraine.

Materials and methods. Weediness monitoring of switchgrass crops was carried out at Veselopodilsk EBS of the Institute of Bioenergy Crops and Sugar Beet during 2008-2013. Switchgrass variety "Cave-in-Rock" was planted at the row width of 45 cm and following rate: 1) 1.54 kg/ha; 2) 4.62 kg/ha; 3) 7.70 kg/ha. Sown area was 168 m^2, accounting area 100m^2. Four times replication, systematic plot placing.

Accounting weed-infested crops was performed by visual quantitative method. Assessment of weeds in crops culture was performed with 0.5×0.5 cm frames, which were placed on diagonal; replication – four times.

Results and discussion. Analysis of observational data showed that weedy component in the investigated agrophytocoenoses under study was diverse. The most widespread dicots were: bitterling (*Polyganum convolvulus* L.), chicken point (*Anagallis arvensis* L.), silene noctiflora (*Silene noctiflora* L.), descurainia sophia (*Sisumbarium sophia* L.), fumaria (*Fumaria officinalis* L.), yellow thistle (*Suncchus arvensis* L.), pink thistle (*Cirsium arvense* L.), field bindweed (*Sonvolvulus arvensis* L.); annual dicots: goosefoot (*Chenopodium album* L.), shepherd's purse (*Capsellabursa pastoris* L.), wild violet (*Viola arvensis* L.), hemp nettle (*Galeopsis tetravit* L.), amaranth (*Amaranthus retroflexus* L.).

The most common grass species were miliary species: foxtail gray (*Setaria glauca* L.), echinochloa crus-galli (*Echinochloa crus-galli* L.).

The total weedy component in switchgrass agrophytocoenosis comprised more than 15 species. A characteristic feature of switchgrass is low competitiveness as compared to weeds. At the period from sowing to germination (about 14-18 days), the area became overgrown with weeds, which have appeared before switchgrass. In the first year of growth (2008) the number of weed in crops ranged from 381 to 664 pcs./m^2, including 198-345 pcs./m^2 of dicotes (Table)

Table

Weediness of switchgrass crops subject to the initial plant stand density over long-term growing

Year	Hydrothermic factor over vegetation period	Plant stand density	Number of weeds		
			total	of these	
				dicot	annual cereal
2008	0.9	184	664	345	319
		554	651	338	313
		924	381	198	183
2009	0.9	253	615	320	295
		744	209	109	100
		1266	123	64	59
2010	1.0	185	668	347	321
		555	392	203	189
		925	134	70	64
2011	1.0	171	714	340	374
		514	427	200	227
		856	143	60	83
2012	0.8	228	647	336	311
		670	380	198	182
		1140	129	67	62
2013	0.9	200	651	338	313
		588	383	199	184
		1000	130	68	62
$LSD_{0.5}$			17.3		

When increasing see spacing from 184 to 924 pcs./m^2, the number of weeds decreased by 1.7 times as much. In 2009 (the second year of vegetation), the total weed number depended on switchgrass stand density and ranged from 123 to 615 pcs./m^2, including annual cereal from 59 to 245 pcs./m^2.

A significant decrease in weediness was observed at stand density of 1266 pcs./m^2 (5 times as much when compared with the density of 253 pcs./m^2 and 3.8 times, compared with 209 pcs./m^2).

A similar trend was noted in 2010 (the third year of vegetation) (Table).

Weeds damaged switchgrass agrophytocoenosis largely in 2011 (the fourth year of vegetation), especially the ones of the *Gramineae* family: foxtail gray, echinochloa crus-galli. Total weed number was 143-714 pcs./m^2. Weeds appeared before switchgrass, which did not compete with them. Under these conditions we cut weeds twice, but were foxtail plants were significantly lower cutting height and restored quickly. Agrophytocenosis state became complicated after rainfall when weeds started to gain vegetative mass actively, in particular broadleaves ones. In such circumstances, most of switchgrass crops were under suppression leading to death. On October 25, the number of switchgrass plant left made up 171 pcs./m^2 at seeding rate of 1.54 kg/ha, 514 pcs./m^2 at 4.62 kg/ha, and 856 pcs./m^2 at 7.7 kg/ha.

In 2012 (the fifth year of growing) the total number of weeds, depending on the plant density, was from 129 to 647 pcs./m^2, including annual cereals 62-311 pcs./m^2. At stand density of 728 pcs./m^2 the number of weeds was 647 pcs./m^2; when 1140 pcs./m^2 - 129 pcs./m^2 (decreased by 5 times as much), respectively.

A similar trend was noted in 2013.

Concerning weediness of switchgrass agrophytocoenosis, it is necessary to note that over 6 years we observed natural self-destruction of weed populations in 2009, 2012 and 2013 yrs. Thus, in 2008, the total number of weeds made up 565 pcs./m^2, then in 2009 it was 316 pcs./m^2, in 2012 – 365 pcs./m^2, in 2013 - 388 pcs./m^2. Reducing in the density of weed populations was for account of echinochloa crus-galli, amaranth. The exceptions were 2010 and 2011. For example, in 2011 the total weed number was 428 pcs./m^2, including annual cereals of 228 pcs./m^2. This is due primarily to the hydrothermic conditions of the

growing season. When switchgrass grew (in April) HTF was 1.3. Weeds have appeared before, and at the time they were intensively gaining vegetative mass, that is why the stand density of switchgrass in that year was the lowest: 171, 514 and 856 pcs./m^2, respectively to seeding rate. Over all the years, weed stand density increased along with decreasing in stand density of switchgrass.

Conclusions.

1. The weediness in switchgrass agrophytocoenosis over long period of growing was influenced both by hydrothermic conditions during growing season and stand density of the crop.

2. For 6 years, at the value of HTF of 0.9 we observed natural self-destruction of weed population: in 2013, the total number of weed decreased by 31.4 %, as compared with 2008.

3. Crops stand density can affect weeds significantly. At stand density of 900,000-110,000 pcs./ha (seeding rate of 7.7 kg/ha) weediness was 3-5 times lower than at the density of 170,000-250,000 pcs./ha. (seeding rate of 54 kg/ha).

4. The most widespread weeds in switchgrass agrophytocoenosis in the Eastern Forest-Steppe of Ukraine is foxtail gray, amaranth, bitterling, goosefoot, galeopsis, pink thistle, silene noctiflora, and descurainia sophia.

References

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Анотація

Мандровська С.М.

Моніторинг забур'яненості в агрофітоценозах світчграсу

Наведено комплексну оцінку забур'яненості посівів світчграсу (Panicum virgatum L.*) за довготривалого використання у Східному Лісостепу України. Встановлено, що структура та загальний рівень забур'яненості посівів світчграсу значною мірою визначається його вихідною густотою, а також метеорологічними умовами вегетаційного періоду.*

Ключові слова: *світчграс, густота сходів, бур'яни, гідротермічний коефіцієнт (ГТК)*

Аннотация

Мандровская С.Н.

Мониторинг засорённости в агрофитоценозах свитчграса

Приведена комплексная оценка засорённости посевов свитчграса (Panicum virgatum L.*) при продолжительном использовании в Восточной Лесостепи Украины. Установлено, что структура и общий уровень засоренности посевов свитчграса в значительной мере обуславливается его исходной густотой, а также метеорологическими условиями вегетационного периода.*

Ключевые слова: *свитчграс, густота всходов, сорняки, гидротермический коэффициент (ГТК)*