THE EFFECT OF DIFFERENT MULCHING TYPES ON THE WEED OF SEA BUCKTHORN

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Abstract

This study was conducted in order to determine how the use of organic (straw, sawdust) and inorganic (Polyethylene, woven fabric) mulches affect weed species composition and weed seed bank in sea buckthorn field. The number and species composition of weeds in the years of the study differed significantly depending on the mulching types. In spring and May, polyethylene and woven fabric versions completely suppressed weeds, while control-2, which didn't fight weeds, had more weeds growing by 34-203 per/m^2 in 2021 and 56-192 per/m^2 in 2022. The yield of one bush was 2939.4 g in the version with woven fabric version, which was 336.1-2714.1 g more than the other versions. fruit yield had a strong negative correlation with the number of weeds P=0.77, and weed biomass had a weak negative correlation with fruit yield P=0.5. 40-69.3 % of weed seed bank in the soil were contained in the 0-10 cm deep stratum and decreased from spring to autumn. Weed seed bank were reduced by 1.1-2.6 times in the mulched versions compared to control 2, and increased by 1.3 times in control 2. In statistical processing, the mulched versions differed significantly in weed seed bank.

Keywords: *Organic , Yield, Weed seed bank, Biomass*

INTRODUCTION

In recent years, following the growing number of organizations and individuals who are interested in gardening with decorative trees and shrubs in their surroundings in foreign countries and domestically, and engaged in family farming and fruit production, new types of fruits and the technology for their cultivation have been updated and intensively changed in the ecological direction. Especially, in regions with limited soil fertility and moisture supply, the use of organic and inorganic materials as soil mulch in order to improve the yield of fruit and berry farming creates an opportunity to efficiently use water and moisture and fight weeds effectively [Tretyakova G.Yu, 2010].

The technological operations of fruit cultivation, such as weed control and irrigation, are carried out manually, which limits the possibility of their efficient cultivation in large quantities on many hectares. A lot of research work has been done in the central agricultural region to test fruit varieties, develop agrotechniques, and produce seedlings, but there has been no research on weeds, especially in fruit orchards with various mulches. In Mongolia, it is one of the most important problems to operate fruit and berry orchards for the production of organic and ecologically clean products as much as possible. Therefore, this work was carried out in order to determine in detail the distribution and species composition of weeds spread in the sea buckthorn field, and to determine how the use of various mulches affects the weed species composition and weed seed bank.

MATERIALS AND METHODS

We conducted this research at a sea bucktorn orchard (49°50[1] N, 105°88[1] E) at the field of experience Institute of Plant and Agricultural science, Darkhan-Uul province, between 2020 and 2022 (Figure 1).

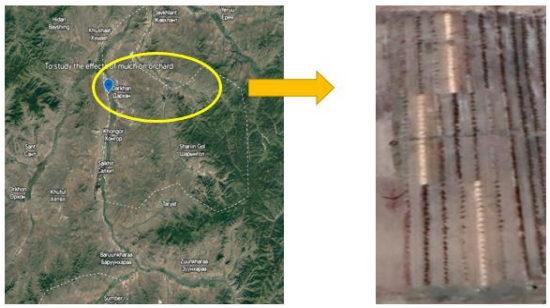

Figure 1. Sea buckthorn fields were covered with organic mulch (straw, sawdust) 1 m wide and 10 cm thick, and inorganic mulch (polyethylene, woven fabric) was studied in comparison with control 2 (no weed control).

The major weeds in the orchard are ranunkelruta *(Leptopyrum fumarioides)*, broadleaf plantain ***(Plantago major)***, flixweed **(*Descurainia sophia)***, field penny ***(Thlaspi arvensis L.)***, artemisia sieversiana ***(Artemisia sieversiana Willd)***, sow thistle ***(Sonchus arvensis L.)***, *canada thistle* ***(Cirsium Arvense)***, Blue lettuce ***(Lactuca tatarica)***, stork's-bill ***(Erodium stephanianum Willd*)**, quackgrass ***(Agropyrum repens*)**, little Lovegrass ***(Eragrostis minor)***, silverweed ***(Potentilla anserina L.)***, lamb's quarters **(*Chenopodium Album L.)***, dwarf mallow ***(Malva neglecta)***, *black bindweed* ***(Polygonum convolvulus)***, *red-root pigweed* ***(Amaranthus retroflexus)***.

Before planting, the field was plowed to a depth of 30 cm and leveled with a GQN-125 rotor. After that, 180 2-year-old saplings of sea buckthorn Chuiskaya variety, meeting the standards of MNS 0916:2011, were planted in pots with a distance of 2 meters between holes and 4 meters between rows, with a hole digger of 1w-70 brand at a depth of 50 cm with a diameter of 60 cm, with 6 versions and 3 repetitions. It was planted in a 720 m^2 area by simple method. The distribution and density of weed population in plots were evaluated by using I.I.Liberstein and A.I.Tulikov's method for defining weed distribution. Number of weed species and weed plants in m^2 , placed on 4 different randomly selected locations within each plot, were counted. Overall weed infestation of plots was rated on 5-point scale, with 1 being least and 5 being critically infested. Weed density m^- was sampled randomly at four places with the help of one square meter and dry weed biomass m^2 at harvest were recorded. The weed control efficiency (WCE) was calculated by using the formula (Kondap and Upadhyay, 1985). Weed seed bank contained in the soil were determined in the laboratory by taking mixed samples from the depths of 0-10 cm and 10-20 cm in spring and autumn for each scenario, and the total number of weed seeds was transferred to ha and expressed as millions (M.Z. Stankov, B. .A. Dospekhov, 1987). Depending on the condition of weeds between the rows during the growing season, weeding was done with a GQN-125 rotor.

RESULT AND DISCUSSION

When determining the distribution and species composition of weeds spread during tillage before planting in the study area, 9 species of weeds from 6 families were noted, when considering weeds by biological group classification, annuals accounted for 42.9 %, biennials 5.0 %, and perennials 52.1 %. The number of weeds in the years studied varied greatly depending on the mulching types.

In the spring of 2021 and 2022, there was no weed growth in the woven fabric version, as the woven fabric effectively blocked sunlight and killed the weed's white germination. Compared to control-2, which did not fight weeds at all, the mulching versions had less litter by 34-203 per/m^2 in 2021 and 56-192 per/m^2 in 2022, respectively.

1. Weeds of experimental versions, per/m^2
2020-2022, May

Year	*Version*	*weed, per/m^2*			*Total*
		Annual	Biennial	Perennial	
2020	Before planting	200	23.5	243	466.5
2021	Control-1	93	1	75	169
	Control-2	56	28	119	203
	Polyethylene	0	0	0	0
	Woven fabric	0	0	0	0
	Sawdust	5	2	55	62
	Straw				
2022	Control-1	21	29	86	136
	Control-2	111	42	39	192
	Polyethylene	0	0	22	22
	Woven fabric	0	0	0	0
	Sawdust	0	0	13	13
	Straw	0	2	20	22

Between the rows of sea buckthorn trees, before the first tillage, there was an average of 228 per/m^2 weeds in 2020-2022. We double-identified weeds for all experimental versions during inter-row processing. The options with woven fabric and Polyethylene mulches achieved 1-2 per/m^2 of weeds, indicating that these mulches reduced weed infestation.

The sawdust version had the highest weed growth than the other mulch versions. However, it was relatively low compared to controls 1 and 2. All study processes in control 1 and control 2 without mulch had a score of 5 or were very weedy. In determining the weed species composition, there were 7.5 families and 10 species on average for 3 years in the control-2 field, which was almost the same in terms of families and species as weeds between the rows. In the woven fabric version, it was seen that the growth of weeds was completely limited by the absence of weeds at this time of the research years.

2. Weed growth in versions during the first tillage between rows of sea buckthorn trees, per/m^2
2020-2022, June

Хувилбар	Weed, per/m^2			
	2020	2021	2022	Average
Between row	*508*	*176*	*210*	*228*
Control-1	313	137	261	237
Control-2	314	425	310	349
Polyethylene	1	-	-	1
Woven fabric	2	-	-	2
Sawdust	32	85	156	91
Straw	26	8	98	44

After identifying weeds, weeds were destroyed and leveled with a Kubota-50 tractor with a GQN-125 rotor. All inter-row weeds are 100% killed.
Before the 2nd tillage between the rows of sea buckthorn trees, in July, 146.67 weeds grew m^2 on average for 2020-2022, and the pattern was the same as the first tillage. Since the cultivation was done once between the rows, mostly annual weeds such as ***Chenopodium album***, ***Polygonum convolvulus***, ***Eragrostis minor***, and ***Artemisia scoparia*** grew. Weeds were not counted in non-organic versions of woven fabric and polyethylene, but weed counts increased in versions with sawdust and straw organic mulches.

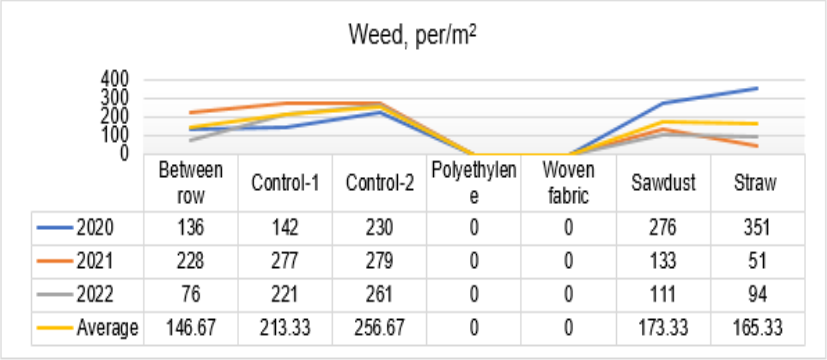

Figure 2. Effect of options on spread weeds before 2nd tillage between rows, per/m^2

Weed density m^2 was sampled randomly at four places with the help of one square meter and dry weed biomass m^2 at harvest was recorded. The weed control efficiency (WCE) was calculated by using the formula (Kondap and Upadhyay, 1985).

The yield per bush in the version with woven fabric was 2939.4 g, or 336.1-2714.1 g more than in other versions. But the Control 2 version has 5 points or 256-380 per/m^2. It created conditions for minimum yield.

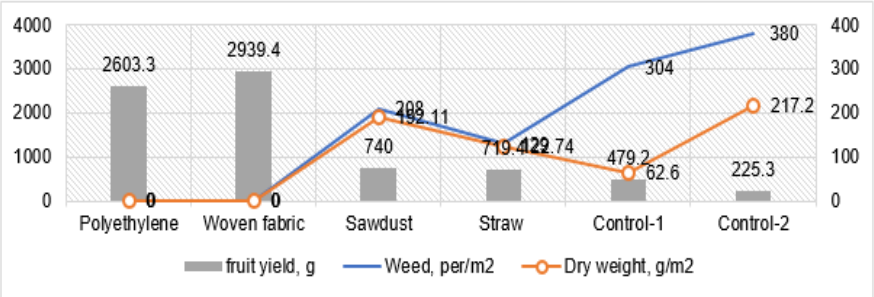

Figure 3. Weed biomass and yield, 2022

Sea buckthorn yield decreases as the number of weeds increases. There was a strong negative correlation between yield and weed number P= -0.77, and a weak negative correlation with weed biomass yield P= -0.5. No differences in weed species composition were observed among the mulch versions.

When determined the weed seed bank in the experimental versions, 69.3% in 2020, 41-77 % in 2021, and 40-67 % in 2022 were contained in the stratum 0-10 cm in the soil. In mulched versions, the weed seed bank decreased from spring to autumn. In the spring of 2020, the weed seed bank in the depth of 0-10 cm in the experimental area was 65.625.000 million/piece, while in the autumn it was increased by 1.1-3.6 times in the control versions without mulch and decreased by 1.2-1.3 times in the 4 versions with mulch.

On the average of 2020-2022, in control 1 and control 2 versions, the seed bank increased by 2.239.583-33.229.167 million/piece, while in the version with sawdust mulch, 14.739.583 million/piece, plastic film 10.729.167 million/piece, woven fabric 10.052.083 million/piece, straw 2.864.583 million/piece was reduced by respectively.

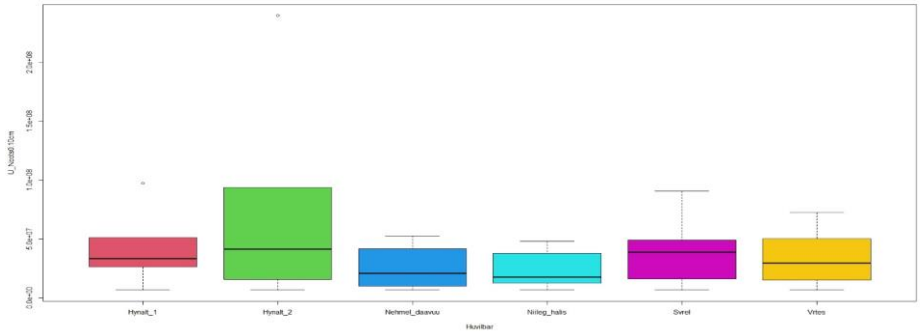

Figure 4. Effect of mulching on weed seed bank at 0-10 cm depth in sea buckthorn field.

In statistical processing, the mulch versions differed significantly in weed seed bank. According to the results of the research, weed seed bank of 0-20 cm depth decrease in the versions where mulch is created from spring to autumn. Compared to the 2021–2022 average for the first year of the study, seed bank was 1.1–2.1 times lower in mulched version, and 1.3 times higher in the control 2 version in the spring of 2020. In the autumn, mulching versions were also reduced by 1.9-2.6 times.

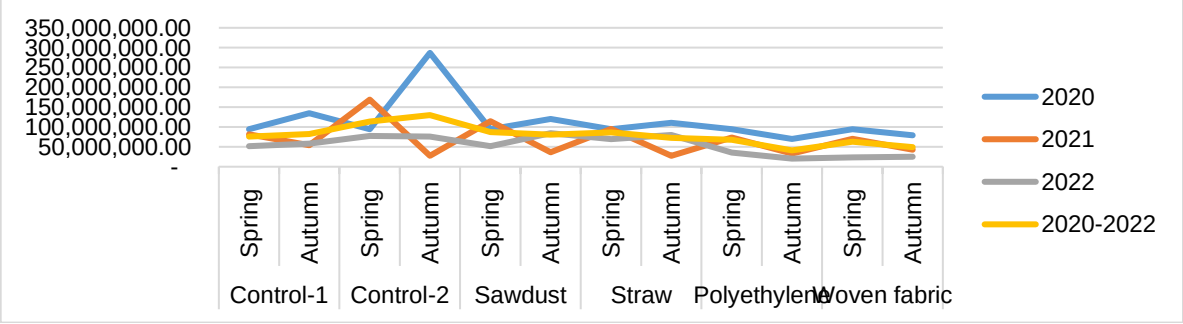

figure 5. The effect of mulch on the reduction of the weed seed bank in sea buckthorn field, million/ piece.

According to the study, there was a significant difference between the 0-20 cm depth of weed seed bank and mulching between 2020 and 2022. Polyethylene and woven fabric versions limit the growth of weeds and reduce the content of their seed bank.

CONCLUSION

According to the results of Dr. Gene Hogue's research conducted in Canada, which is similar to Mongolia in terms of climate, weeds were combated in the fruit fields by mulching shredded paper and tree trunks, planting alfalfa, mustard, winter rye, and clover. Control weed was 340 per/m^2, tree bark 30 per/m^2, paper 28 per/m^2, control weed biomass was 19 g/m^2, tree bark 15 g/m^2, paper 3 g/m^2. Studies have shown that paper and tree bark have good suppression of weeds. Since 2007, in the 1 ha mother garden of Haskap of the Plant Genetic Resources Sector of the Institute of Plants and Agriculture Science, we have been using woven fabric mulch made in China, which reduces the frequency of irrigation by 2 times and reduces the growth of weeds. /Atarsaikhan T, 2018/. In a comparison of mulches such as black plastic film, woven fabric, dolomite, etc. in the mother garden of Blue Dam film, it was found that plastic film mulch is positive for plant growth and reduces the growth of weeds, but woven fabric material is better than plastic film in terms of durability. /Uuganbaatar N, 2019/. In the years of the study, the polyethylene and woven fabric mulching versions produced 2939.4 g in the woven fabric mulching version, or 336.1-2714.1 g yield more than the other versions, and the weed seed bank was reduced by 1-2.6 times, which is similar to the research work of the above researchers.

RESULT

1) In the first year of the study, 9 species of weeds from 6 families were recorded during tillage before planting. In 2021-2022, depending on the type of mulch, the number of weed families and species is decreasing. The woven fabric version completely suppresses weeds.
2) In the spring, polyethylene, woven fabric, and straw mulches limit the growth and development of weeds, impairing their respiration and reproduction, and the results of the study showed that weeds did not grow at all. The sawdust version had an average of 53-75 per/m^2 of weeds, which was the highest compared to the mulched versions.
3) The yield per bush in the version with woven fabric was 2939.4 g, or 336.1-2714.1 g more than in other versions. But the Control 2 version has 5 points or 256-380 per/m^2. It created conditions for minimum yield.
4) Sea buckthorn yield decreases as the number of weeds increases. There was a strong negative correlation between yield and weed number P= -0.77, and a weak negative correlation with weed biomass yield P= -0.5. No differences in weed species composition were observed among the mulch versions.
5) Weed seed bank in the experimental versions, 69.3 % in 2020, 41-77 % in 2021, and 40-67 % in 2022 were contained in the stratum 0-10 cm in the soil. In mulched versions, the weed seed bank decreased from spring to autumn.
6) Seed bank compared to the average of 2021-2022, spring mulched versions decreased 1.1-2.1 times, while the control 2 version increased 1.3 times in soil 0-20 cm depth of 2020.

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