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VOLOSHYNA V., research officer
Symyrenko Institute of Pomology NAAS of Ukraine
e-mail: varvaravoloshina@yandex.ru

GROWING APPLE SEEDLINGS ON VEGETATIVE ROOTSTOCKS IN NURSERY-GARDEN USING DIFFERENT KINDS OF MULCH

Given are findings on the effect of different mulch kinds applied to apple seedlings on vegetative rootstocks in nursery-garden on their development and marketability. The most efficient kind of mulch was sawdust applied together with fertilizer as well as humus (0.5 layer) + sawdust (0.5 layer) + peat (0.5 layer) + sawdust (0.5 layer). Under this condition a profitability index rose by 7.2 - 92.8% and 11.1-98.2%, respectively, as compared to standard; net profit amounted to 360,900-892,700 UAH/hectare.

Keywords: *apple; nursery-garden; mulch; moisture; pruning; generative structure; marketability; profitability*

Introduction. Pomiculture is a traditional sector of agriculture in many countries, including Ukraine. It comprises growing variety of fruits and berries, among which apple takes a special place owing to its bio-technological and organizational-economic characteristics [6].

Modernization of Ukrainian pomiculture must start from cultivation of high-quality planting material to ensure rapid ripening and high yield of quality fruit. Seedling must feature a well-formed crown, i.e. have its side branches with fruit buds ensuring first harvest in the year of planting in orchard. Peculiarity of planting material formation in a nursery depends on both the stock and biological characteristics of pomological variety [10].

Growing standard apple tree (especially that on dwarf rootstock) without irrigation is really impossible. The need for moisture is large in the first months after planting rootstock in the first field of nursery and on the second year after spring monitoring of inoculated trees in the second field. According to long-term meteorological data, this period (April and May) is marked with a lack of rainfall, yet significant losses occur from soil moisture evaporation [1].

Of all the farming practices contributing to high productivity of nursery garden and maintenance of soil fertility, mulching is of great importance [9]. To mulch we can use organic mulching materials, such as humus, peat, compost, chopped straw, leaves, grass, sawdust etc. [5, 2, 11, 12]. However, it should be noted that sawdust and straw comprise much carbohydrates, which when being decomposed by microorganisms, increase the absorption of nitrogen from the soil, exhausting the soil layer, which provide plant root system. To avoid this, mulch must be enriched with mineral nitrogen fertilizer (ammonium nitrate) at a rate of 50-60 g/m^2. To mulch in early spring one can use manure of caw or of other cattle containing great amount of straw [4, 5, 9, 11].

Mulching is one of the simplest and most affordable ways that can prevent salinization in irrigated areas. As mulch we can use cardboard, roofing and polyethylene film [4]. At present this issue is of great relevance, since the introduction of such practice keeps the soil in the nursery garden ready to provide an increased yield of high quality planting material in accordance with international standards and reduces labour costs of cultivation.

The objective of our research is to study the effect of different types of mulch in nursery garden on growth processes and marketability of apple seedling.

Materials and methods. The research was carried out during 2004-2008 at the Central branch of the Symyrenko Institute of Pomology NAAS of Ukraine, located in the central Right-Bank Forest-Steppe at an altitude of 125 m above sea level.

The objects of research are different organic mulches: pine sawdust, straw from winter wheat, lowland peat, cattle humus.

*The subject*s of the research are: rootstocks M.9 and 54-118; varieties Rennet Symyrenko, Idared and Florina.

Experiment to study the influence of mulch in nursery garden on growth, development and yield of standard apple trees in the western part of the Right-Bank Forest-Steppe of Ukraine was laid as following: mulching with sawdust (with additional fertilizing), sawdust mulching (without fertilizing), humus mulching, mulching with straw (with additional fertilizing), mulching with straw (without fertilizing), mulching with peat, humus mulching (0.5 layer) + sawdust (0.5 layer), mulching with peat (0.5 layer) + sawdust (0.5 layer), control (no mulch, no watering), standard (no mulch, with watering).

Mulch was applied in rows immediately after planting rootstocks. Variants 1-8 were designed to preserve moisture in the upper productive layer of soil by mulch materials, to save energy and water, to reduce hand and machine works.

Variant 9 served as control, i.e. growing technology without irrigation. Variant 10 served as a standard of technology using irrigation.

Rootstocks were of the first grade. The scheme of planting was 70×20 cm (71.4 pcs./ha). Four-time replication was done. There were 25 plants in each replication (100 plants in each variant). Variants were placed in a way of randomised blocks.

Accounting and monitoring were carried out in accordance with convenient methods of pomiculture [7]. Mathematical processing of the results was performed using one factor dispersion analysis [3].

The climate in the area is temperate continental, although there could be divergence towards sharp continentality and tempering because of high-pressure belt moving.

Soil is shallow, of low humusness, slightly leached loamy grained black soil on calcareous aeolion bottom layer. Soil layer of 0-60 cm, where most roots are, is dark-gray, variegated, of grain-powder structure, granularity is weak. Change to subsurface is gradual. Humus content in 0-60 cm layer: from 3.6 % (0-20 cm) to 2.1 (40-60 cm). pH 7.4, hydrolytic acidity from 1.29 (0-20 cm) to 0.91 (40-60 cm) meq 100 g of soil. Provision with mobile phosphorus and potassium is optimal.

Findings. In general, weather conditions over the years of experiment were favourable for growing quality planting material. Mean rainfall during the growing season amounted to 338 mm according to long-term observations. The maximum mean precipitation (of 56.7 mm) falls in June, July and August. These months are the warmest.

Analysis of soil moisture content and mineral nutrients provision over years of research ensured that all the organic mulches have been used in studies are suitable for mulching in nurseries.

During 2004-2008, the mean soil moisture in 0-60cm layer ranged from 17.1% to 18.9 % of absolutely dry soil, corresponding to 70-80% of the least water-absorbing capacity according to Kuian [8]. All other variants (with mulch) ensured preservation and accumulation of moisture in the upper soil layer from 17.6% to 18.9%, respectively. The highest soil moisture (71.0-72.5 %) in the experiment, in the mean for 2004-2008 recorded in variants of mulching with peat (0.5 layer) + sawdust (0.5 layer) and humus (0.5 layer) + sawdust (0.5 layer).

Readying soil before laying the experiment was carried out pursuant to the recommendations for growing plants [8]. Soil was sampled to determine the NPK content prior to the laying the first field (in spring of the same year).

Indicators of NPK provision in soil varied significantly both over the years of research and horizons. In the depth of 0-20 cm the NPK content was the highest, while it decreased in the lower horizons. In 0-60 cm soil layer, NPK content before laying the experiment was on average either optimal or high over the years. Respectively, the NPK content varied over years of the experiment. It was established that the largest nitrate nitrogen content accumulated in the upper soil layer (0-20 cm), both in the first and second field of nursery. Thus, when mulching with humus or humus (0.5 layer) + sawdust (0.5 layer) in the first field it was 107.5 and 96.6 mg/kg of soil, respectively; when mulching with peat (0.5 layer) + sawdust (0.5 layer) - 71.1 mg/kg of soil. In the second field nitrate nitrogen carry-over was observed over variants by nearly half - 63.3, 41.1 and 25.9 mg/kg of soil,

respectively. These values are 2.2 - 1.2 times higher than in the control and standard variants, respectively. Nitrate nitrogen content gradually decreased in the lower layers.

Despite a kind of mulch, an average content of mobile phosphorus was high in the 0- 60cm horizon over the years. It was found mostly in the 0-20cm layer: 56.9 mg/100 g in the first field when humus mulching, 51.9, 50.7 and 44.7 mg/100 g of absolutely dry soil, respectively, in the variants with humus mulch (0.5 layer) + sawdust (0.5 layer), sawdust and peat (0.5 layer) + sawdust (0.5 layer).

Data analysis on the exchangeable potassium shows that its content ranged from 6.5 to 47.3 mg/100 g (1^{st} field) and from 5.2 to 23.4 mg/100 g (2^{nd} field), which considered to be optimal.

Effect of soil temperature on the growth and development of plants, in particular fruit-bearing plants is undoubted. Our studies (2004-2008) proved that soil becomes warmed differently under different mulches in the hottest months of the growing season (July- August). All the variants with mulch had lower soil temperature by a factor of ten (3-10˚C) as compared to the control, i.e. no mulch, no watering (30.9- 27.1˚C) and standard (no mulch, with watering). The lowest soil temperature was recorded under straw mulch. Among the variants with mulch, the highest temperature in the experiment was recorded under peat mulch (19.0-25.1˚C), then under humus (18.8-24.1˚C). In the variants with humus mulch (0.5 layer) + sawdust (0.5 layer) and peat mulch (0.5 layer) + sawdust (0.5 layer) the mean soil temperature was 16.7-22.4˚C and 18.2 – 22.8˚C, respectively, which is by 6.2 – 7.3˚C and 5.7 – 6.8˚C lower than in the control and standard, respectively.

In the first nursery field the average survival rate was 94.3 % for both kinds of rootstocks. The thickness of the rootstock at the site of inoculation was measured prior to inoculation. It fluctuated, on average, from 7.3 to 10.0 mm. The lowest thickness was marked at the rootstock 54-118 and M.9 (7.3 and 8.4 mm, respectively) when mulching with peat. The highest indices were recorded in variants with humus (0.5 layer) + sawdust (0.5 layer) at rootstock 54-118 and M.9 - 8.5 and 10.0 mm, respectively; somewhat lower in variants with peat (0.5 layer) + sawdust (0.5 layer) 8.2 and 9.7 mm, respectively.

The main indicators of plant growth and development are biometric ones: height, trunk diameter, mean and total length of shoots and their number in one seedling; the size of the leaf blade and the total area of foliage on the plant - in terms of hectares. The analysis of the seedling growth in terms of variants established that in the middle of the growing season (July), when growth processes are more intense, the difference in all variants of mulching was more significant: by 1.5-11.5 cm higher to control and standard. Gradually (August -September) the difference was minimizing and there was no significant deviation to control and standard (from 0.2 to 1.4, a maximum of 2.0 cm).

Clearly marked is a positive trend of growth processes in experiments combined different mulching, i.e. humus (0.5 layer) + sawdust (0.5 layer) and peat (0.5 layer) + sawdust (0.5 layer). At the end of growing season these variants recorded strong grows (7.7-23.0 %) and, consequently, higher seedlings, as compared to control and standard. The most significant effect on all growth processes was observed in apple seedlings with following kind of mulch: humus (0.5 layer) + sawdust (0.5 layer) and peat (0.5 layer) + sawdust (0.5 layer). On average, indices there exceeded the control by 21.4 % and standard by 13.6 %. In terms of forming crown they exceed an average value by108.6 % to control and 57.5 % to standard.

Mulching contributes to the growth and development of seedlings, increases light level provided in the crown and chlorophyll in the leaves, and also has a positive impact on the number of generative structures. The largest amount of chlorophyll in the leaves was estimated, on average over years of research, in combined variants: humus (0.5 layer) + sawdust (0.5 layer) and peat (0.5 layer) + sawdust (0.5 layer). The mean data on the number of generative structures over years of research was there by 11.9-107.7 and by 7.5-61.7% higher to control and standard, respectively.

Root system analysis showed that roots are mainly placed (from 45 to 70 %) in soil layer 5-15 cm. The use of complex mulch, i.e. humus (0.5 layer) + sawdust (0.5 layer) and peat (0.5 layer)

+ sawdust (0.5 layer) ensured preservation of productive moisture in the soil layer, which led to an half - twice increase in branching of root system, as compared to control and standard, respectively.

Yield of seedlings was calculated with the aid of mean yield of 1st and 2nd grade marketable seedlings according to relevant pomological variety and variant (Tables 1, 2 and 3).

Table 1

Yield of Rennet Symyrenko seedlings depending on mulching soil in the nursery garden (average of 2005, 2007 and 2008)

Variant	Total (thousand pcs./ha)	1st grade		Of these with formed crown		2nd grade	
		thousand pcs./ha	%	thousand pcs./ha	%	thousand pcs./ha	%
Rootstock M. 9							
Sawdust (with additional fertilizing)	41.7	18.3	43.8	15.9	86.8	23.4	56.1
Sawdust (no additional fertilizing)	37.9	12.8	33.7	10.0	78.1	25.1	66.2
Humus	45.3	16.7	36.8	12.8	76.6	28.6	63.1
Straw (with additional fertilizing)	40.0	16.0	40.0	10.7	66.8	24.0	60.0
Straw (no additional fertilizing)	37.7	9.8	25.9	5.5	56.1	27.9	72.4
Peat	44.5	12.9	28.9	10.7	82.9	31.6	71.0
Humus + sawdust (each of 0.5 layer)	48.0	35.2	73.3	33.0	93.7	12.8	36.3
Peat + sawdust (each of 0.5 layer)	45.6	30.2	66.2	29.7	98.3	15.4	33.7
Control (no watering, no mulching)	33.5	4.8	14.3	1.7	35.4	28.7	85.67
Standard (no mulching, with watering)	36.1	13.1	36.3	5.7	43.5	23.1	63.9
Rootstock 54-118							
Sawdust (with additional fertilizing)	47.1	31.5	66.9	30.6	97.1	15.6	33.1
Sawdust (no additional fertilizing)	44.4	16.4	36.9	12.3	75.9	28.0	63.6
Humus	44.4	16.4	36.9	12.3	75.9	28.0	63.6
Straw (with additional fertilizing)	50.6	27.5	54.3	23.3	84.7	23.1	45.6
Straw (no additional fertilizing)	45.6	23.3	51.0	17.1	73.3	22.3	48.9
Peat	48.6	17.6	36.2	14.7	83.5	31.0	63.7
Humus+ sawdust (each of 0.5 layer)	59.5	43.1	72.4	43.1	100	16.4	27.5
Peat + sawdust (each of 0.5 layer)	57.1	46.6	81.6	46.3	99.3	10.5	18.3
Control (no watering, without mulching)	34.3	7.6	22.2	2.5	32.9	26.7	77.8
Standard (no mulching, with watering)	46.0	16.0	34.8	12.2	76.2	30.0	65.2

Mean yield of marketable produce in successful variants collected during the years of research was 37,300 pcs./ha. Of that 62,900 pcs./ha of variety Florina on rootstock M.9 in the variant with peat (0.5 layer) + sawdust (0.5 layer) and Idared variety on rootstock 54-118 in the variant with peat (0.5 layer) + sawdust (0.5 layer). Slightly lower it was in varieties Idared and Rennet Symyrenko on the rootstock 54-118 in variant with humus (0.5 layer) + sawdust (0.5 layer) - 58.9 and 59.5 pcs./ha (Table 1, 2 and 3).

Table 2

Yield of Idared seedlings depending on mulching soil in the nursery garden (average of 2005, 2007 and 2008)

Variant	Total (thousand pcs./ha)	1st grade		Of these with formed crown		2nd grade	
		thousand pcs./ha	%	thousand pcs./ha	%	thousand pcs./ha	%
Rootstock M. 9							
Sawdust (with additional fertilizing)	51.5	19.6	38.0	5.9	30.1	31.9	61.9
Sawdust (no additional fertilizing)	45.1	17.5	38.8	3.8	21.7	27,6	61.1
Humus	41.3	17.8	43.0	3.1	17.4	23.5	56.9
Straw (with additional fertilizing)	36.7	9.9	26.9	2.6	26.2	26.8	73.0
Straw (no additional fertilizing)	33.5	8.8	26.2	2.6	29.5	24.7	73.7
Peat	41.9	2.7	6.4	0.9	33.3	39.2	93.6
Humus+ sawdust (each of 0.5 layer)	53.7	34.4	64.0	17.3	50.2	19.3	35.9
Peat + sawdust (each of 0.5 layer)	51.8	26.8	51.7	16.3	60.8	25.0	48.2
Control (no watering, no mulching)	38.9	9.2	23.6	1.2	13.0	29.7	76.3
Standard (no mulching, with watering)	44.0	13.1	29.2	2.6	19.8	30.9	70.2
Rootstock 54-118							
Sawdust (with additional fertilizing)	52.3	28.8	55.0	13.2	45.8	23.5	44.9
Sawdust (no additional fertilizing)	49.3	24.5	49.6	5.3	21.6	24.8	50.3
Humus	45.1	34.7	76.9	4.4	12.6	10.4	23.0
Straw (with additional fertilizing)	46.8	31.7	67.7	8.6	27.1	15.1	32.2
Straw (no additional fertilizing)	43.9	16.3	37.1	5.7	34.9	21.9	61.8
Peat	43.2	9.2	21.2	2.1	22.8	34.0	78.7
Humus+ sawdust (each of 0.5 layer)	58.9	49.3	83.7	24.3	49.2	9.6	16.9
Peat + sawdust (each of 0.5 layer)	62.9	48.1	76.4	26.3	54.6	14.8	23.5
Control (no watering, no mulching)	43.5	16.3	37.4	4.4	26.9	27.2	62.5
Standard (no mulching, with watering)	52.1	22.7	43.5	6.1	26.8	29.4	56.4

The highest percentage of 1st grade seedlings (% of total marketable seedlings) marked following variants: 51.7 % in Idared variety on rootstock M.9 in variants with peat (0.5 layer) + sawdust (0.5 layer) and - 91.4 % in variety Florina on rootstock M.9 in variant with humus (0.5 layer) + sawdust (0.5 layer). These figures are twice as much higher than those in control and standard variant, respectively.

Table 3

Yield of Florina seedlings depending on mulching soil in the nursery garden (average of 2005, 2007 and 2008)

Variant	Total (thousand pcs./ha)	1st grade		Of these with formed crown		2nd grade	
		thousand pcs./ha	%	thousand pcs./ha	%	thousand pcs./ha	%
Rootstock M. 9							
Sawdust (with additional fertilizing)	34.1	17.7	51.9	14.1	79.6	16.4	48.1
Sawdust (no additional fertilizing)	32.1	13.5	42.0	9.9	73.3	18.6	57.9
Humus	36.0	14.7	40.8	8.7	59.2	21.3	59.1
Straw (with additional fertilizing)	30.6	17.6	57.5	12.0	68.2	13.0	42.4
Straw (no additional fertilizing)	27.1	14.3	52.8	9,0	62.9	12.8	47.2
Peat	33.2	12.6	37.9	3.5	27.8	20.6	62.0
Humus + sawdust (each of 0.5 layer)	38.3	35.0	91.4	32.7	93.4	3.3	8.6
Peat + sawdust (each of 0.5 layer)	37.3	31.1	83.4	28.2	90.6	6.2	16.6
Control (no watering, no mulching)	29.0	9.8	33.8	4.0	40.8	19.2	66.2
Standard (no mulching, with watering)	36.2	17.5	48.3	9.9	56.6	18.7	51.6
Rootstock 54-118							
Sawdust (with additional fertilizing)	49.9	35.5	71.1	26.5	76.6	14.4	28.8
Sawdust (no additional fertilizing)	47.2	29.2	61.8	20.9	71.5	18.0	38.1
Humus	47.2	37.1	78.6	25.8	69.5	10.1	21.3
Straw (with additional fertilizing)	40.1	29.0	72.3	19.0	65.5	11.1	27.6
Straw (no additional fertilizing)	35.5	23.5	66.2	17.4	74.8	12.0	33.8
Peat	45.2	23.7	52.4	8.1	34.8	21.5	47.5
Humus + sawdust (each of 0.5 layer)	58.1	49.8	85.7	45.2	90.7	8.3	14.2
Peat + sawdust (each of 0.5 layer)	56.3	49.9	88.6	45.2	90.5	6.4	11.3
Control (no watering, no mulching)	42.1	22.3	53.0	11.5	51.5	19.8	47.0
Standard (no mulching, with watering)	46.9	25.0	53.3	18.9	75.6	21.9	46.6

The results on planting material with formed crown cultivated with mulches differed significantly from control and standard variant.

Thus, the higher percentage (% out of 1st grade) among planting material with formed crown was obtained in variant with humus (0.5 layer) + sawdust (0.5 layer): 50.2-93.7 % on rootstock M.9 and 49.2-100.0 % on rootstock 54-118; with peat (0.5 layer) + sawdust (0.5 layer): 60.8-98.3 % on rootstock M.9 and 54.6 -99.3% on rootstock 54-118. In control and standard variants these figures were as following: 13.0-40.8 % on rootstock M.9, 26.9-51.5 % on rootstock 54-118 and 19.8-56.6 % on rootstock M.9, 26.8-75.6 % on rootstock 54-118, respectively.

Cost-effectiveness analysis, especially in terms of profitability, allows concluding that not all the mulches could be recommended for introducing to technology of growing apple varieties Rennet Symyrenko, Idared and Florina on rootstocks M.9 and 54-118.

Variety Rennet Symyrenko *on the rootstock M.9*: humus (0.5 layer) + sawdust (0.5 layer) - profitability index rose by 54.2 % and 98.2 % to the control and standard, respectively; peat (0.5 layer) + sawdust (0.5 layer) - an increase of 40.4 % and 80.4 %; sawdust with additional fertilising - an increase of 23.0 % and 58.1 %. *On the rootstock 54-118*: peat (0.5 layer) + sawdust (0.5 layer) – an increase of 88.6 % and 71.8 %; humus (0.5 layer) + sawdust (0.5 layer) - an increase of 92.8 % and 75.7 %; sawdust with additional fertilising - an increase of 51.1 % and 37.6 %, respectively.

Variety Idared *on the rootstock M.9*: humus (0.5 layer) + sawdust (0.5 layer) - profitability index rose by 29.6 % and 60.4 % to the control and standard variant, respectively; sawdust with additional fertilizing - an increase of 21.8 % and 50.7 %; peat (0.5 layer) + sawdust (0.5 layer) - an increase of 19.7 % and 48.1 %. *On the rootstock 54-118*: peat (0.5 layer) + sawdust (0.5 layer) - profitability index rose by 35.2 % and 52.4 % in control and standard variant, respectively; humus (0.5 layer) + sawdust (0.5 layer) - an increase of 26.1 % and 42.1 %; sawdust with additional fertilizing - an increase of 7.8 % and 21.5 %, respectively.

Variety Florina *on the rootstock M.9*: humus (0.5 layer) + sawdust (0.5 layer) - profitability index rose by 39.6 % and 43.1 % to the control and standard variant, respectively; peat (0.5 layer) + sawdust (0.5 layer) - an increase of 29.6 % and 32.8 %; sawdust with additional fertilizing – an increase of 8.3 % and 11.0 %; *on the rootstock 54-118:* humus (0.5 layer) + sawdust (0.5 layer) - profitability index rose by 28.0 % and 59.4 % to the control and standard variant, respectively; peat (0.5 layer) + sawdust (0.5 layer) - an increase of 24.0 % and 54.5 %; sawdust with additional fertilizing - an increase of 7.8 % and 33.5 %, respectively.

It was found that the most effective ways of mulching are: humus (0.5 layer) + sawdust (0.5 layer), peat (0.5 layer) + sawdust (0.5 layer), sawdust with additional fertilizing. In these variants, profitability index rose by 7.2-92.8 % and 11.1-98.2 % to the control and standard variant, respectively; net profit is 360,900-892,700 UAH/ha.

Conclusions

1. To keep moisture in the soil layer of 0-60 cm at 70-80 % level when growing apple trees in the nursery garden on rootstocks M.9 and 54-118 it is necessary to mulch soil with sawdust, humus, peat and straw.

2. All kinds of mulch contribute to the accumulation of mineral nutrients and normalizing soil temperature, which significantly influences growth of apple trees.

3. Such variants as humus (0.5 layer) + sawdust (0.5 layer) and peat (0.5 layer) + sawdust (0.5 layer) provided seedling yield of 37.3 - 62.9 pcs./ha, that is from 1.5 to 2 times higher than control and standard ones, respectively. Profitability increased by 7.2 %-92.8 and 11.1-98.2% to control and standard variant, respectively; net profit by 360,900-892,700 UAH/ha.

References

1. Волошина В.В. Мульчування у плодових розсадниках / В.В. Волошина // Здобутки та перспективи вітчизняного садівництва: зб. наук. праць / [Редкол.: І. І. Хоменко (відп. ред.) та ін.]. – Корсунь-Шевченківський: ФОП Майдченко І. С., 2009. – С. 97-101.

2. Джекс Дж.В. Мульчирование / Дж.В. Джекс, У.Д. Бринд, Р. Смит // Техническое сообщения № 49 бюро почвоведения Британского содружества наций; [пер. с англ.

И.Ф. Блохина]. – М.: Изд-во ин. лит., 1958. – 218 с.

3. Доспехов Б. А. Методика полевого опыта (с основами статистической обработки результатов исследований). – [5-е изд., доп. и перераб.]. – М.: Агропромиздат, 1985. – 351 с.

4. Клименко С.В. Голая почва открытая всем невзгодам / С.В. Клименко // Огородник. – 2002. – №4. – С. 17-18.

5. Клименко С.В. Хто не поважає мульчу, той не знає ціни гумусу / С.В. Клименко // Дім, сад, город. – 2004. – № 5. – С. 12-14.

6. Кондратенко П.В. Адаптація яблуні в Україні / П.В. Кондратенко – К.: Світ, 2001. – 192 с.

7. Кондратенко П.В. Методика проведення польових досліджень з плодовими культурами / П.В. Кондратенко, М.О. Бублик. - К.: Аграрна наука, 1996. – С. 95.

8. Куян В.Г. Плодівництво / В. Г. Куян. – К.: Аграрна наука, 1998. – 467 с.

9. Мазур П. Мульчування плодових дерев / П. Мазур // Дім, сад, город. – 2003. – №5. – С. 16.

10. Программно-методические указания по агротехническим опытам с плодовыми и ягодными культурами / [Под ред. проф. Н.Д. Спиваковского]. – Мичуринск, 1956. – 184 с.

11. Рубін С. С. Ефективність мульчування при вирощуванні садивного матеріалу / С.С. Рубін, П. М. Федченко // Сад та город. – 1936. – № 7. – С. 16-17.

12. Струков Н. Мульчирование в борьбе с сорной растительностью / Н. Струков // Сборник ВИЗР / Всесоюзная академия с.-х. наук им. В.И. Ленина. – Ленинград: [б.и.], 1933. – № 5. – С. 68-72.

Анотація

Волошина В.В.

Вирощування саджанців яблуні на вегетативних підщепах із застосуванням у розсаднику різних типів мульчі

Викладено результати досліджень по вивченню впливу різних типів мульчі у розсаднику на ростові процеси та товарність саджанців яблуні на вегетативних підщепах. Встановлено, що найбільш доцільно мульчувати тирсою (з підживленням); а також перегноєм (0,5 шару) + тирсою (0,5 шару) та торфом (0,5 шару) + тирсою (0,5 шару). У цих варіантах показник рівня рентабельності зріс на 7,2…92,8 % та 11,1…98,2 % відповідно до контролю та еталону; чистий прибуток – 360,9-892,7 тис. грн./га.

Ключові слова: *яблуня, розсадник, мульча, вологість, кронування, генеративні утворення, товарність, рентабельність*

Аннотация

Волошина В.В.

Выращивание саженцев яблони на вегетативных подвоях с применением в питомнике различных типов мульчи

Изложены результаты исследований по изучению влияния различных типов мульчи в питомнике на все ростовые процессы и товарность саженцев яблони на вегетативных подвоях. Установлено, что наиболее целесообразно мульчировать опилками (с подкормкой), а также перегноем (0,5 слоя) + опилками (0,5 слоя) и торфом (0,5 слоя) + опилками (0,5 слоя). В этих случаях показатель уровня рентабельности вырос на 7,2...92,8 % и 11,1...98,2 % соответственно к контролю и эталону; чистая прибыль – 360,9-892,7 тыс.грн/га .

Ключевые слова: *яблоня, питомник, мульча, влажность, кронирование, генеративные образования, товарность, рентабельность*