AGRISCIENCE AND TECHNOLOGY
Armenian National Agrarian University
ԱԳՐՈԳԻՏՈՒԹՅՈՒՆ ԵՎ ՏԵԽՆՈԼՈԳԻԱ АГРОНАУКА И ТЕХНОЛОГИЯ
International Scientific Journal
ISSN 2579-2822

Journal homepage: anau.am/scientific-journal
doi: 10.52276/25792822-2022.4-379

UDC 635.646:631.559+635.649:631.559(479.25)

The Influence of Hail Protection Net Application on the Yield Capacity and Quality of Eggplant and Pepper in Conditions of Ararat Valley, RA

G.A. Tovmasyan, R.N. Nazaryan
Armenian National Agrarian University
tarniltd1@rambler.ru, rudiknazaryan@yahoo.com

ARTICLE INFO

Keywords:
eggplant,
pepper,
hail protection net,
shading,
cultivation

ABSTRACT

To obtain high quality and abundant yield product from vegetable crops, it is necessary to improve cultivation technology by applying new agricultural measures and introducing modern agricultural systems, which will allow to obtain competitive products in the market at low costs. Research has been carried out at the ANAU Voskehat experimental farm in 2022. During the research respective eggplant and pepper varieties were cultivated in open field with hail protection net shading. The experimental data showed that net shading had positive effect on the growth, development, quantity and quality of eggplant and pepper yield, providing 45 and 22 c per-hectare yield surplus, respectively.

Introduction

In Armenia vegetable crops are grown in all agricultural zones, but the Ararat valley remains the main specialized zone for vegetable cultivation, where, according to long-term average data, more than 65 percent of vegetable crops are planted (Grigoryan, 1999). For many economic entities of the republic the vegetable growing is considered the main production area and plays a major role in both agriculture and the entire economy of the country.

According to the data of the RA National Statistical Committee, in 2021 the cultivated areas of vegetable crops in the republic amounted to 21.3 thousand hectares, which is 9.6 % of the total cultivated areas. A total of 692.8 thousand tons of vegetables were produced, which were mainly consumed in the local market, and also exported (Statistical Yearbooks, 2021).

Vegetable crop cultivation is among the advanced branches of the agricultural system, since being intensive crops, they require a large amount of resources per hectare, such as irrigation water, fertilizers, machinery, transportation, etc. Therefore, they contribute to increasing the level of agricultural intensification, soil fertility, and the yield of subsequent crops (Balashev and Zeman, 1981, Krug, 2000, Andreyev, 2003). Herewith, cultivation of vegetables is also associated with significant difficulties, as most vegetables are considered to be perishable products, their treatment is labor-consuming, transportation is difficult; besides, they require quick harvesting and marketing (Grigoryan, 1999, Melikyan, 2005).

Increasing the efficiency of vegetable crops cultivation is a necessary condition for enlargement of sowing areas and involvement of new species and varieties in cultivation.

From this point of view, it is necessary to continuously improve cultivation technologies, apply new agro-measures, regionalize new varieties and hybrids and to contribute modern agricultural systems, the application of which will enable to obtain low-cost and competitive products in the market. Anyhow, in Armenia, in order to introduce new crops or new technologies into production, first of all it is necessary to prove their advantages over traditional crops or technologies to the farmers, which we have tried to do throughout our research activities.

Materials and methods

The study was conducted within the framework of the joint program "Intitutional strengthening-demonstration field in the Armavir region" implemented by Armenian National Agrarian University and National Institute of Agricultural Technology, Argentina (INTA).

Using INTA's practice, during the vegetation period of 2022 innovative technologies for growing agricultural crops were experimented in the area of 850 m altitude above sea level, allocated in the Voskehat teaching-experimental farm of ANAU.

Eggplant variety of "Hoktemberyan 3" and pepper variety of "Nush 55" were cultivated under the shading of hail protection net and without it in the open field. The height of the net from the ground surface was 2.8 m, the vertical parts of the field edges were open and the nets were raised.

In all experimental plots under study a drip irrigation system was installed through which the crops were irrigated and regularly nurtured during the entire vegetation period.

In all experimental plots the inter-row spacing of crops was 60 cm and the inter-plant spacing was 40 cm. This is due to the scheme of efficient field surface use and irrigation system. The precursor during the previous cultivation was cucumber.

The experiments were carried out with 2 variants in 3 replications and the calculated area of one experimental bed was 144 (9.6 x 15) square meters. Eggplant and pepper seedlings were received from the Scientific Centre of Vegetable and Industrial Crops of the RA MoE. For planting eggplant seedlings (45-day-old with 20-25 cm height) and pepper seedlings (45-day-old with 18-20 cm height) were transported to the experimental field without pots. Seedlings were sorted before planting. Only healthy, thick-stemmed seedlings were planted and the rest were rejected. Seedlings of eggplant and pepper were planted on May 18-22, 2022 in all experimental plots. Parallel to planting, the first irrigation was implemented through drip irrigation system. A week after planting recovery work was carried out in the experimental beds: dried out seedlings were replaced by new ones in order to ensure full vegetation cover.

The same treatment activities were carried out in all experimental plots: weeding and hoeing – 5 times, irrigation – every 3-4 days in the evenings, starting from the planting period up to 10 days before harvest, control over diseases and pests with chemical preparations, feeding 3 times with the dose of $N_{20}P_{20}K_{20}$, together with irrigation. During the vegetation period phenological observations and biometric measurements were carried out, according to the accepted methodology for field experiments (Dospekhov, 1985). The final harvest date for all variants has been set up as October 21st.

The first harvesting was implemented at the stage of fruits technical maturity, then it continued regularly once or twice a week. Harvesting in the pepper fields went on also at the stage of fruits biological ripening: the red fruits of pepper were collected.

The commodity groups of the yield were determined according to the EEC UN standards, based on which they were divided into the first and second groups. Non-standard fruits were left out from yield accounting (UNECE standard ffv-05 - 2017).

Short description of the tested eggplant and pepper varieties

Hoktemberyan 3 /eggplant/. The mentioned variety was bred through local population selection. It is a mid-season variety, it takes 110 days from mass sprouting to technical maturity, while biological maturity lasts 132 days. The variety is recommended to be cultivated in open ground conditions.

The plants are clustered, the average height is 65 cm, the width is 45 cm. The stem is free of thorns. The leaves are large, elongated oval and without thorns. The fruits are large, oblong-cylindrical, dark purple, with a shiny surface. The average fruit length is 22.5 cm, width is 6.3 cm and the average weight is 310g. The flesh is delicate, spongy, white, the taste has no bitterness. The total yield capacity is 720 tons/ha. The variety is relatively resistant to diseases.

Nush 55 /pepper/. This variety was produced through mutagenesis, from Lastochka variety. It is an early maturing indeterminate variety. The period from germination to the technical ripening of the fruits lasts 95-105 days. The fruits are conical, large, with a broad base. The mass of fruits at the technical ripening stage is 70-80 g and in the stage of biological ripening their weight is 80-90 g.

At the stage of technical ripening, the fruits are green, at the stage of biological ripening – red. Dry matter is 4.5-5.8 %, biological matter is 6.8-7.4 %. The yield is up to 500 c/ha. The fruits are used fresh and processed.

Results and discussions

When choosing the patterns of vegetable crops planting, it is necessary to take into account their feeding area, which is determined per the plant's requirements and, of course, according to the working parts and wheels of the machine tools, as well as the capture width (Melikyan, 2005, Krug, 2000, Andreyev, 2003). In our experimental plots the inter-row spacing for eggplant and pepper was 60 cm, based on the above stated conditions and the possibilities of irrigation system operation. The system was installed in rows with a distance of 60 cm, the drippers were opened at 40 cm intervals. Taking into account that eggplant and pepper are light-demanding crops (Melikyan, 2005, Sarukhanyan, 2016, Andreyev, 2003), such a feeding area provided sufficient light conditions and reduced the negative impact of plants mutual shading. The requirement of seedlings per one hectare was about 41600 items.

Eggplant and pepper seedlings were planted in the test plot on May 18-22 related to weather conditions. The high heat demand of eggplant and pepper was taken into account, as well as the effective temperature background (22-25 degrees)

for plant growth in that period. In such temperature conditions the seedlings spend only 30 % of assimilation substances for respiration and excretion of substances (de-assimilation), but during further stages of growth and development and in high temperature conditions it can reach up to 90 % (Gharibyan, 2014, Krug, 2000).

Table 1. Transitional periods of phenological stages for eggplant and pepper*

Crop	Cultivation conditions	Germination	Blooming	From germination to the start of fruit maturation, days	
				technical	full
Eggplant	Under net	18/05	30/06	68	-
	Without net	20/05	28/06	64	-
Pepper	Under net	21/05	02/07	65	89
	Without net	22/05	01/07	61	87

*Composed by the authors.

High seedling survival rates were recorded in all net-shaded plots, where during the recovery activities fewer seedlings by about 40 % were used as compared to the variants cultivated without netting. In all cases, the same density of vegetation cover was ensured in the test plots: dried out seedlings were replaced with new ones during a week.

Regarding the phenological phases of eggplant and pepper the periods from germination to blooming and start of fruits technical maturation were estimated, the results of which are presented in Table 1. From the data in the table, it is obvious that eggplants are more sensitive to the net shading factor, as in the case of the earliest germination, the plant blooming was recorded 2 days later, compared to the blooming process recorded in the net-free variant, where the germination was 2 days later compared to that of net shading variant. In case of pepper, the plants under the net germinated a day earlier, but the blooming was recorded one day later compared to the net-free variant. According to another estimation, if the blooming of eggplants was recorded with a 4-day difference, then it was 1-2 days for pepper plants. These differences can be explained mainly by the thermal factor and the effect of direct sunlight on the plants, the high rates of which can cause stress in the eggplant and pepper crops, which accelerates the development processes.

A similar pattern was recorded between the initial periods of the fruits technical ripening, after which, until October 21, harvesting was carried out regularly, 1-2 times a week, but in August and September the harvesting frequency was twice a week. It is worth mentioning that in the net-free variant, harvesting of eggplant and pepper started 4 days earlier in comparison with those in net shading condition, making 68 and 65 days after planting, respectively.

Vegetable plants highly depend on soil fertility and they grow, develop and yield well in nutrient-rich soils. At the same time, it should be taken into account that a number of external factors, such as heat, humidity, solar radiation, etc., have a great impact on the assimilation of nutrients by plants. Since the plants moisture supply was at the same level, it is supposed that the heat factor is the main reason for some but at the same time regular differences between the plants height in all experimental variants of both crops. In all variants of net shading cultivation, the average height of plants exceeded that of plants grown in net-free conditions, thus, in case of eggplant it was 18.8 cm and in case of pepper it was only 5.3 cm. The normal vegetative growth of plants, and therefore the effective height of plants, results in many lateral branches, on which more crop rings and a great number of fruits are developed (Melikyan, 2005, Tarakanov and Mukhin, 2003).

In environmentally favorable conditions relatively larger

fruits are developed on exuberant plants, which contain sufficient amount of nutrients, and their weight does not harm the mother plant. Throughout the experiments, the average weight of eggplant and pepper fruits was measured during the entire harvest period by weighing samples taken from all experimental beds after each harvest. It is obvious that relatively larger fruits were produced in all options with net shading cultivation, which are closer to the indicators presented in the varietal characteristics. The difference amounted to 15 grams per eggplant fruit, and 7 grams per pepper fruit (Table 2).

Table 2. Biometric indicators, actual yield and marketable quality of eggplant and pepper yield*

Crops	Cultivation conditions	Average height of a plant at the beginning of harvest, cm	Average weight of a fruit, g	Harvesting duration, days	Actual yield, c/ha	Marketable groups of the yield, %	
						Class I	Class II
Eggplant	Under net	92.4	312	88	325	78	17
	Without net	73.6	297	90	280	72	22
Pepper	Under net	68.3	91	88	268	79	15
	Without net	62.7	84	91	246	82	14

*Composed by the authors.

The first harvesting of eggplant and pepper was conducted when the fruits obtained marketable form and the seeds in the fruits were not yet hardened. As to pepper, after the second decade of September, when harvesting green fruits, a certain amount of fruits was left on the plants, which ripened red and were collected at the stage of biological ripening and were counted in the total harvest amount. During the experiments, the first harvest of eggplant and pepper fruits cultivated in net-shaded conditions was carried out on July 25, and those of non-shaded option were harvested 2-3 days earlier – on July 23 and 22, respectively. The indicators of the harvesting duration are estimated, since the last harvest for all options was implemented on October 21. The total yield amount obtained as a result of periodically conducted harvesting was calculated and then sorted in the field according to two marketable groups, containerized and immediately sent for consumption. For both tested crops, a high quantity and quality yield was obtained in case of net shading options: 325 c/ha for eggplant and 268 c/ha for pepper, which were higher than those in non-shaded options by 45 c/ha and 22 c/ha, respectively. In the yield marketable groups, the non-shaded pepper variety was an exception, where the number of first-class fruits was higher than that of the net-shaded variant by 3 %. It is believed that this difference is due to the number of fruits left for biological ripening, which were of relatively higher quality.

Conclusion

Based on the results of our studies obtained throughout vegetation period of 2022, we may conclude that the use of hail protection nets in the vegetable growing branch has an important agro-technical and economic significance. It provides the farmers an opportunity not only to protect open fields from natural disasters such as hailstorms, but also to somehow regulate the environmental conditions, particularly the heat factor and radiation, creating more effective growing conditions for crops. Based on the results of these studies, it is recommended to use field hail protection nets in open field conditions, especially in the areas of vegetable crop cultivation in the Ararat valley, which can serve as an effective technological factor to ensure possibly high-quality and rich commercial yield.

References

1. Andreyev, Yu.M. (2003). Vegetable Growing, Moscow, - p. 250 (in Russian).
2. Balashev, N.N., Zeman, G.O. (1981). – Vegetable Growing, Tashkent, - p. 368 (in Russian).
3. Dospekhov, B.A. (1985). Field Experiment Methodology, - p. 351 (in Russian).
4. Gharibyan, G. (2014). Vegetable Growing – Yerevan, - p. 160 (in Armenian).
5. Grigoryan, K.A. (1999). "Problems of Vegetable Production, Processing Economics and Marketing in RA", Yerevan, - p. 45.
6. Krug, G. (2000). Vegetable Growing, Moscow, Kolos, - p. 576.
7. Melikyan, A.Sh. (2005). Vegetable Growing, Yerevan, - p. 503.
8. Sarukhanyan, N. (2016). Solanaceous Crops, a Guide, Yerevan, - p.42.
9. Statistical Yearbooks, 2021 www.armstat.am/am/?nid=586&year=2021.
10. Tarakanov, G.I., Mukhin, V.D. (2003). Vegetable Growing, Moscow, Kolos, - p. 478 (in Russian).
11. UNECE Standard ffv-05 - United Nations New York and Geneva, 2017.

Accepted on 07.11.2022
Reviewed on 08.11.2022