Materials of Conferences

PRODUCTION TECHNOLOGY OF SELF-ROOTED VINE SEEDLINGS

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Here we show some aspects of production technology of self-rooted vine seedlings as well as the results of field experiments for the study of irrigating regimes, total and average daily evapotranspiration of grapes nursery in the open ground, and nutrition schemes. The studies have been performed on brown soils of the southern slope of the Volga upland Volgograd region, Russia. By results of research the most effective was a differentiated regime of drip irrigation in the period of establishment and active growth of cuttings at the level of 85...90 % of the lowest water holding capacity of the soil (LWHC), and after the beginning of ripening of seedlings at the level of 70…75 % LWHC. This irrigation regime ensured the output of the standard seedlings at the level of 70 %.

The cultivation of high-quality planting material of grapes is the act of a pressing issue in all grape-growing regions of Russia. Updating old plantings and expanding new production places high demands on the seedlings, which, in turn, dictates the need to improve the efficiency of the used production technologies of vine seedlings and increase their yield. Thus, specialists of all-Russian scientific research Institute of viticulture and winemaking indicate that in Russia it is necessary to plant 9-10 thousand ha of new plantations annually. This requires about 22 million seedlings, including at least 17 million inoculated and 5 million self-rooted [5]. The annual demand for seedlings in the Volgograd region is estimated at 300 thousand pieces and the actual production of standard seedlings does not exceed 150 thousand, i.e. half of the required number [2].

According to research data of both scientists and growers, cultivation of vine seedlings is possible only in conditions of irrigation regardless of growing region because of the root development of cuttings requires high soil moisture and surface air layer [2, 4, 5, 6, 8, 9]. In the area of brown soils of the Volga upland in dry steppes, rainfall is less than 300 mm per year. When growing a vine nursery in the outdoors, irrigation is necessary.

Previous research shows that scientists developed the technology of cultivation of the vine nursery using mulch film to preserve moisture and heat [9]. Drip irrigation technology of vine nursery on the black soils was studied in the works of A.V. Dutova and others [4].

The aim of our study was to obtain the highest possible output of the standard self-rooted vine seedlings based on the substantiation of the water regime of the soil and ensure its irrigation regimes in combination with fertilizer application, preplant preparation of cuttings and foliar top dressing of nursery.

Materials and methods of research. The experimental plot located in LLC "Dubovsky vinograd" of Volgograd area in 2007-2010. Soils of the experimental plot are brown sandy loam. The humus content was 1.73 %, the availability of mineral nitrogen and movable phosphorus was low (1,9 and 0.79 mg/100 g of the soil accordingly), exchangeable potassium was medium (21,0 mg/100 g of the soil). The LWHC of 18.3 % of the mass of absolutely dry soil. The moisture conditions of the vegetative period during years of research was: 2007 – dry (Hydro-termic ratio HTR = 0,6), 2008 – medium humid (HTR = 0,8), 2009 – medium (HTR = 0,7), 2010 – very dry (HTR = 0,5).

The scheme of experiment included two factors that were irrigating regime (A) and nutrition scheme (B): A1 – drip irrigation of the soil layer of 0.0-0.6 m at the moisture level of 70...75 % LWHC; A2 – drip irrigation of the same layer of the soil at the level of 85...90 % LWHC; A3 – drip irrigation in the phase of root establishment at the level of 85...90 % LWHC at the same soil layer and at the phase of wood ripening of the seedlings – at the level of 70...75 % LWHC at the soil layer of 0.0-0.6 m both. B1 – $P_{40}K_{60}$ implemented together with fall soil tillage, fertigations with $N_{12}P_5$ were implemented 10 times during the period of vegetation (base experimental variation). B2 – base variation nutrition scheme + 12 hour presoak of bottom ends of the cuttings with "Radifarm". B3 – nutrition scheme under variation B2 + foliar feedings with "Master" (18:18:18 + 3), dosage 5 kg per ha every two weeks; after wood maturing starts "Master" (3:11:38 + 4) same dosage and intervals. Control variation was A2B1.

The experimental variations were arranged by randomization method [3]. Count area amounted to 8,4 m2, or 12 linear meters of two-line series. This area allocated 240 cuttings. In our experiments, we used cuttings of the vine variety Riesling Rhenish. Soil moisture monitored using tensiometers. Calculation of irrigation norms [7], evapotranspiration [10], the output of the first grade seedlings [1].

Results of research and their discussion. Preliminary examination and experimental testing of various planting schemes of the cuttings into the nursery, allowed us to choose, in our opinion, the optimal planting conditions for the Low Volga region. So, for the industrial production of vine seedlings under drip irrigation in brown soils of the southern slope of the Volga upland, we recommend to use a planting scheme: two-line series on the

rollers, covered with foil, with the distance between drip lines 1,4, series of 0,2, and cuttings in series 0,1 m (Fig. 1) [2].

Water supply of the vine nursery during the growing season determined by the weather conditions and irrigation regimes. On average in the first variation 16 irrigations by 200 m^3/ha were performed, in the second – 28 irrigations by 125 m^3/ha and in the third – 19 irrigations by 125 and 3 by 200 m^3/ha (Table 1). Restrictions on irrigation in the third variant was determined by the phase of the beginning of the ripening vines, which occurred averagely, on August 14.

Evapotranspiration analysis showed that it varied depending on water regime of the soil. In average, the highest water consumption of 4708 m^3/ha observed in the second research variation. In the structure of evapotranspiration, irrigation water dominated, its share calculated at least 70% of the total moisture amount used by the vine nursery (Table 2). The highest average daily evapotranspiration up to 40 m^3/ha was in the variation of the water regime 85...90% LWHC (Fig. 2).

The main goal of vine nursery production is to ensure a high survival rate of the cuttings. From the point of view of the quality of the planting material, durability of future plantings and economic benefits, it is necessary to achieve the highest yield of first grade seedlings among survived cuttings. In our experiments, the highest output of the first grade seedlings, amounting to 70%, was in the variant with maintaining soil humidity no less than 85...90% LWHC with a reduction to 70...75% LWHC and the principal application of foliar sprays with Master (Table 3). On average for the water regime factor, in the first variation, the output of the first grade seedlings was 44.9% (varying by schemes of fertilizer application from 31,4 to 57.6%), in the second 52,7% (varying from 38,4 to 67,3%), and in the third of 56.7% (varying from 44.3 to 70%).

Fig. 1. Vine nursery with drip irrigation lines

Table 1

The number and distribution of irrigations of vine nursery on average years of research

Variations for the pre-irrigation moisture, % LWHC	Number of irrigations	Monthly/irrigating rate, m^3/ha						Total irrigation, m^3/ha
		May	June	July	August	September	October	
70…75	16	1/100 3/200	4/200	4/200	3/200	up to 1/200	1/150	3000
85…90	28	1/100 5/125	7/125	8/125	6/125	1/125	1/150	3469
85…90/ 70…75	24	1/100 5/125	7/125	7/125	3/200	up to 1/200	1/150	3325

Table 2

Evapotranspiration structure of vine nursery in average for the research years

Variations for the pre-irrigation moisture, % LWHC	The use of initial soil moisture		Precipitation		Total irrigation		Evapo-transpiration
	m^3/ha	%	m^3/ha	%	m^3/ha	%	m^3/ha
70…75	144	3,4	1095	25,8	3000	70,8	4239
85…90	144	3,2	1095	24,1	3469	72,7	4708
85…90/70…75	144	3,3	1095	25,0	3325	71,7	4564

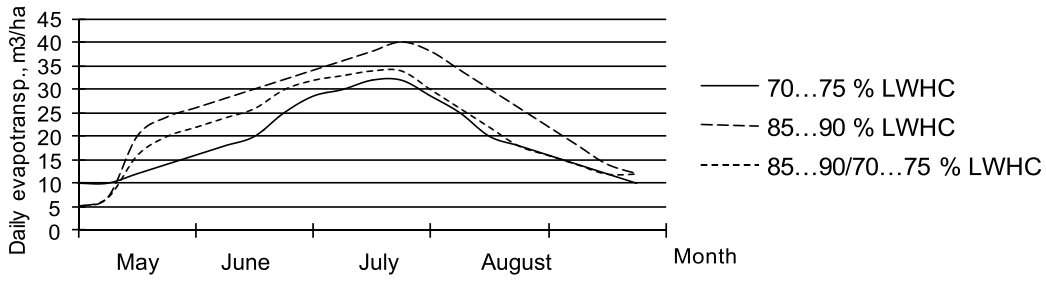

Fig. 2. Daily evapotranspiration of vine nursery, m^3/ha

Table 3

Output of the first grade seedlings on average for the experiment

Variation of the experiment	Well-Rooted cuttings, %	Out of well-rooted cuttings	
		First grade seedlings, %	Seedlings of the other grades
A_1B_1	64,4	31,4	33,0
A_2B_1(control)	68,1	38,4	29,7
A_3B_1	69,4	44,3	25,1
A_1B_2	74,7	45,7	29,0
A_2B_2	84,7	52,3	32,4
A_3B_2	85,3	55,7	29,6
A_1B_3	75,7	57,6	18,1
A_2B_3	84,0	67,3	16,7
A_3B_3	85,7	70,0	15,7
On average for A_1	71,6	44,9	26,7
On average for A_2	78,9	52,7	26,3
On average for A_3	80,1	56,7	23,5
On average for B_1	67,7	39,2	28,5
On average for B_2	81,95	52,2	29,8
On average for B_3	82,3	65,4	16,9

Notes: The Least significant difference (LSD_{05}) 2007 – 0,7; 2008 – 2,0; 2009 – 3,7; 2010 – 4,5.

Conclusion

As a result of the conducted research, it is established that it is necessary to maintain soil moisture in the layer of 0.6 m is not less than 85...90% to phase maturation of the vines and 70...75% LWHC in the subsequent by conducting 3 drip irrigations with the norm of 200 m3/ha and 19 irrigations with the rate of 125 m3/ha with distribution by month from May to September: 5:7:7:3:1. In addition to the vegetation should be preparatory and pre-harvest irrigation

with norm of 100 and 150 m^3/ha. The recommended water regime of the soil must be combined with the following scheme of fertilizers: application with fall tillage P_{40} K_{60}. Since the phase of 2...3 leaves, and then every 10...14 days until wood maturing phase to fertigate with nitrogen and phosphate fertilizers of carbamide and orthophosphoric acid at a dose of $N_{12}P_5$ (10 dressings). Before planting the bottom ends of the cuttings must be soaked for 12 hours in "Radifarm". Together with mentioned, since the phase of three leaves and then every 10 to 12 days further foliar sprays with Master (NPK in the ratio 18:18:18 + 3) in the dose of 5 kg/ha; and in the period of maturing of seedlings of the same preparation at a ratio of NPK 3:11:38 + 4 the same dose.

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