

INFLUENCE OF THE DRIP IRRIGATION ON THE PHYSICAL AND CHEMICAL PLUMS CHARACTERISTICS

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Abstract

The premise of scientific and technical experiments was to evaluate the behaviour during storage of the 2 cultivars of plums ('Stanley' and 'Anna Spath'). Fruits were held after the harvest period of about 7-45 days, depending on cultivar, storage spaces, storage of the resort, where the experiments were subsequently taken and kept in cold conditions ($t = 3-5^{\circ}\text{C}$; UR-95%) over a period of 30 days in cold storage of Belciugatele Teaching Station, located inside of Moara Domnească farm. After removal from storage were made determinations regarding: the recorded quantity and quality of the losses of fruit during storage; the chemical evolution of the main components of plums during storage; The drip irrigation was started from March 20, water was given 4 hours per day. The amount of water needed are between 300 and 700 m³/ha. Among the tested cultivars, Anna Spath performed best, which was ranked on the first place with 2,26 % total loss without loss by spoilage.

Key words: chemical, drip irrigation, losses, storage, varieties

INTRODUCTION

Making a modern fruit growing cannot be conceived without providing a corresponding hydric regime that fruit species need (Cohen D., 1993). Currently, irrigation is necessary to be understood, the principles of integrated fruit growing, highly effective as a tool for regulating the activity of vegetative and productive trees (Iancu M., 2006). It is known that a slight water stress amplification phenomenon has the effect of fruit bud differentiation (Popescu M., Godeanu I., 1989). Also, reducing splashing and the excessive vegetative growth of shoots directing the assimilated to the fruits (Gherghi A., 1983). Influence of drip irrigation on production quality is the effect on the nutritional and food value of fruits (Atkinson D., 1977). Nutritional and food value of the fruits represents the purpose for growing fruit trees, fruit bushes and strawberries as supplements of vitamins, sugars, minerals, acids and energy (calories) needed for proper body growth and development (Botu I., Botu M., 2003). Plums in controlled storage conditions can prolong the storage period of 2 months without losing its qualities. Storage and consumption

during the same organoleptic characteristics depend on the terms offered and the particular variety. It is known that during storage, the fruits suffer structural-textural changes that are produced slower or faster depending on the characteristics of varieties and storage conditions (Gherghi A. et al., 2001).

MATERIALS AND METHODS

The content of this paper is based on research, observations, experiments, extensive research of issues prioritized and data processing including the whole range of issues, starting from the foundation of the application irrigation necessity. As a result, the entire work is based almost exclusively on their research findings on the effect of irrigation on apple and plum at Moara Domnească farm conditions. The elaborations of the researches for this paper were carried out in 2011-2012. Locality is included in the relief of the Romanian Plain, the Vlăsiei Plain subdivision in the area of transition from steppe to forest area. The general appearance of the landscape is flat, with small bumps and depressions many called depression of different shapes and sizes.

Groundwater is at different depths from 6 m to 10 m depending on relief. In 2011, the accumulated rainfall was 288 mm, and 501.6 mm in 2012. All values are under the multiannual average on 50 years, of 548.0 mm. The soil belongs to Moara Domneasca reddish brown type (preluposol), subtype softness.

To establish the ability to maintain quality fresh plums taken 2 more spread cultivars in the current assortment in our country, 'Stanley' and 'Anna Spath'. The premise of the scientific and technical experiments was to assess behavior during winter storage of the 2 varieties of plums introduced in the experimentation. Fruits were kept after harvest a period of about 7-45 days, depending on cultivar, in the storage spaces of the resort, from where they were then taken for experiments and refrigerated in storage conditions (t=3-5°C, RH = 90-95%) in cold storage of Belciugatele Didactic Station, located inside the Moara Domneasca Farm. The experiments were conducted in 6 different comparative variants based on variety and storage conditions (Table 1).

After removal from storage, it were made determinations regarding the following:

- the quantitative and qualitative losses recorded by the fruit during storage;
- evolution of the main chemical components of the apples during storage.

Existence of optimal flow experience across storage-keeping with reference to standardized packaging units, space conditioning, refrigeration thermostatic cell, organoleptic testing laboratory, equipment and devices for measurements and analyzes provided made it possible to achieve this goal.

During storage it has been made the daily examination of the thermal-hydric factors in the refrigeration room, for ensuring that optimal conditions to maintain the quality. Also we proceeded to assess the ability to maintain fruit quality by findings the appearance changes occurred regarding dehydration, the appearance and evolution of different storage disease. Taking into account the high degree of maturity of the fruit during storage and quality changes occurring during storage it was estimated that during cold storage the limit is 45 days. After removing plums from the storage space the determinations were performed on the table and impairment losses (spoilage), biochemical

analysis of the main components. Determination of mass loss and spoilage during storage products was done by weighing samples of fruit resulted, respectively the fruit impaired (spoiled) during storage, compared with the initial amount deposited, the results being expressed as a percentage.

Tests for the main chemical components (dry substance, total sugar, titratable acidity) were performed by standard laboratory methods as follows:

- dry substance was determined by refractometry method using ABB table refractometer with results expressed in %;
- total sugar by Berthrand method with results expressed in %;
- acidity by titrimetric method with results expressed in % of malic acid;

Table 1. Experimental variable

Cultivar and storage conditions	Temp °C	CO ₂	Storage period (days)
Stanley/hemibioza	28-30	-	7
Stanley/fizioanabioza	3-5	-	14
Stanley/chimioanabioza	3-5	4	21
AnnaSpath/hemibioza	28-30	-	7
AnnaSpath/fizioanabioza	3-5	-	14
AnnaSpath/chimioanabioza	3-5	4	21

RESULTS AND DISCUSSIONS

Influence of drip irrigation on plums chemical and physical characteristics

The results of the quantitative and qualitative losses recorded by the fruit during storage at the experimental variants are presented in Table 2.

After 7 days of plum storage at ambient temperature, it was registered weight losses between 10.74% and 20.02% and by spoiling from 2.20% to 26.67 %, depending on cultivar. Total losses during storage are between 12.94% at 'Stanley' and 46.67%, at 'Anna Spath' cultivar. 'Stanley' registered total losses 4 times lower than 'Anna Spath', because of lower weight losses and very low damage losses.

After 30 day of cold storage, plums registered 11.71% - 15.15% weight losses and spoiled losses between 0 and 6.60%, depending on cultivar.

Table 2. Loss during preservation at plums

Cultivar	Weight %	Damage %	Totals %	Storage period days
Stanley-hemibioza	10.74	2.20	12.94	7
Stanley-fizioanabioza	11.71	-	11.71	30
Stanley-chimioanabioza	0.49	-	0.49	45
Anna Spath-hemibioza	20.02	26.67	46.69	7
Anna Spath-fizioanabioza	15.15	6.60	21.75	30
Anna Spath-chimioanabioza	0.58	6.20	6.78	45

Total losses were by 11,71% at 'Stanley' cultivar and by 21.75% at 'Anna Spath'. 'Stanley' cultivar registered the lowest level of weight losses and no damage losses.

After 45 days in chimioanabiosis conditions plums presented weight losses between 0.49 % and 0.58%. Spoiled losses were between 0-6.20%, depending on cultivar.

'Stanley' cultivar registered a total losses percent by 0.49% and 'Anna Spath' registered 6.78%. 'Stanley' cultivar recorded a very low total losses percent because of a low level of weight losses and no damages during the storage. The evolution of the main chemical components during storage are presented in Table 3.

Table 3. Chemical components evolution on plums

Cultivar	Dry soluble substance %		Titrable acidity %		Total sugar %	
	initial	final	initial	final	initial	final
Stanley-hemibioza	15.57	17.02	0.77	0.77	9.70	11.33
Stanley-fizioanabioza		19.33		0.49		11.97
Stanley-chimioanabioza		19.77		0.59		11.80
Anna Spath-hemibioza	22.57	24.22	0.92	0.95	10.45	11.97
Anna Spath-fizioanabioza		15.33		0.70		10.95
Anna Spath-chimioanabioza		16.65		0.78		11.02

Initial dry substance content was between 15.57% and 22.57%, titratable acidity values were between 0.77 and 0.92% and total sugar content was 9.70% and 10.45%, depend on variety.

'Anna Spath' cultivar presents an initial dry substance content, titratable acidity and total sugar higher than 'Stanley' cultivar.

The plums storage for 7 days at ambient temperature had a dry soluble substance content ranged from 17.02%-24.22%, titratable acidity ranged from 0.77%-0.95% and total sugar ranged from 11.33%-11.97%, depend on cultivar.

In hemibiosis conditions, the 'Anna Spath' plums cultivar presents a higher content in dry substance, titratable acidity and total sugar than 'Stanley' cultivar. The tendency of main compounds was to increase dry substance and total sugar content and stationary initial titratable acidity content.

The plums storage in refrigerated conditions during 30 days, have a dry substance content between 15.33-19.33%, titratable acidity between 0.49-0.70% and total sugar content between 10.95-11.97%, depend on cultivar.

The fruits from 'Stanley' cultivar had a higher dry substance and total sugar content than 'Anna Spath' fruits.

The tendency of main chemical components was to increase dry substance and total sugar and decrease titratable acidity comparative to initial values. An exception is 'Anna Spath' variety where the dry substance content decrease comparative with initial value.

After 45 days by storage in chimioanabioza conditions, plums registered a content in dry substance between 16.65-19.77%, a titratable acidity content between 0.59-0.78% and 11.02-11.80% content in total sugar, depend on cultivar.

The fruits from 'Stanley' cultivar presents a higher dry substance and total sugar content than fruits from 'Anna Spath' cultivar.

Comparative with initial values, plums presents an increase of dry substance and total sugar content and a decrease of titratable acidity content.

Table 4. Physical features of plum cultivars

Cultivar	Fruit weight average-g	% of kernel	Form index
Stanley	30.8	6.5	1.30
Anna Spath	34.1	14.4	1.04

Regarding some physical characteristics, 'Stanley' cultivar has a weight of the fruit by 30.8 g, lower than 'Anna Spath' weight were the kernel percent is bigger and decrease the fruit weight (Table 4.)

CONCLUSIONS

Conclusions on losses

The total losses registered by plum varieties, during storage depending on variety and storage conditions.

Among the cultivars tested best behavior was 'Stanley' cultivar which ranked first a total loss of 25,14 % for all storage conditions, almost without losses through spoilage 2.20%.

Conclusions on changes in chemical constituents

Initial content of the main chemical components registered important differences depending on cultivar. 'Anna Spath' presents a higher initial content in dry substance and total sugar comparative with 'Stanley' cultivar.

During storage the level of some chemical components increased or decreased, depending on variety and storing conditions.

The fluctuations have lower values comparative with other studied species.

During cold storage, tendency was to increase dry substance and total sugar content and to decrease titratable acidity content.

Conclusions on fruit size

The studied varieties differs in fruit size and form index. The average weight of the fruit ranges from 30.8 g and 34.1 g. Highest weight was registered at 'Anna Spath' cultivar, 34.1 g but the kernel weight (which was bigger than 'Stanley's) decrease the fruit weight.

The form index was between 1.04 and 1.30, depending on cultivar; the biggest value was registered at 'Stanley'.

REFERENCES

Atkinson D., 1977. The effect of trickle irrigation on the distribution of root growth and activity in fruit trees. *Seminaires sur l'irrigation localisee, Bologne Italie 6/9 novembre.*

Botu I., Botu M., 2003. The modern and sustainable fruit tree culture. Ed. Conphys, Râmnicu Vâlcea.

Cohen D., 1993. Water deficit and plant growth. *Hort. Science*, vol. 21, nr. 5.

Gherghi A., 1983. Fruits and their importance. *Technic Editure, Bucharest.*

Gherghi A et all., 2001. *Biochemistry and Fiziology of fruits.* Romanian Academy Editure, Bucharest.

Gherghi A. et all., 1989. Tutorial on technology for keeping of horticultural products. ICPVILF, Technical tutorial nr. 60.

Iancu M., 2006. Drip irrigation in fruitculture. *Horticulture nr.8.*

Popescu M., Godeanu I., 1989. Local irrigation, a future method for fruittree culture irrigation.