Scientific Papers. Series B, Horticulture. Vol. LVIII, 2014
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

AGRO-MORPHO-PRODUCTIVITY POTENTIAL OF SOME APRICOT CULTIVARS IN THE SOUTH-EAST ROMANIAN PLAIN

Jeni Veronica ȚIU, Sorin Mihai CÎMPEANU, Valerica TUDOR, Adrian ASĂNICĂ

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti, District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67

Corresponding author email: veratiu@yahoo.com

Abstract

Making a modern fruit grow cannot be conceived without ensuring adequate hydric needs for fruit species alongside fertilization. Researching every attribute and specific character for complex systems which are biological known and new wants obtained through the process of apricot breeding required specific methods of collecting, processing and interpreting of data. Technological variants were studied using localized irrigation (b2) and irrigation associated with foliar fertilization (b2c2) on the behaviour of three cultivars of apricot ´Dacia´(a1), ´Comandor´(a2) and ´Tudor´ (a3) (Prunus armeniaca L.), grafted on Mirobolan, with different periods of maturation, in terms of the South-East of Romania, where optimal conditions are encountered. From this paper, studies found that a version of localized irrigation technology is associated with foliar fertilization (b2c2) and had influence on the characteristics of tree vigour, i.e. crown volume and trunk section area (TSA) on the production of fruit but also on the quality of the fruit items (average weight of the fruit, soluble dry matter, acidity and firmness). The crowns shape was not influenced by the application the experimental factors, these being the genetic attribute of each cultivar (´Dacia´ - spherical shape, ´Comandor´ - spherical and slightly alongeted shape and ´Tudor´ - pyramidal shape).

Key words: *apricot cultivar, drip irrigation, experimental variant, foliar fertilizer, quality*

INTRODUCTION

Modern conception of apricot culture in an high density system required a cultivar with an architecture which can allow small distance planting without diminishing complex mechanized possibilities, unhindered lightning of the crown with application upon the normal process of photorespiration and other physiological and biochemical processes which reflects production quality and uniformity.

Making a modern fruit grow cannot be conceived without ensuring adequate hydric needs for fruit species alongside fertilization (Amiri et al.,2008). Even in areas where 600-700 mm annual rainfall is recorded, there is a need to cover water deficiency during July-September, or sometimes in March and April, before and during flowering and fall in October, during the intense growth of roots. Irrigation with a drip system uses less water than sprinkler irrigation (Proebsting, 1994).

Foliar fertilization is necessary to create a favourable nutrient medium in order to obtain high yields of profitable indicators of quality (Bertschinger et al., 1997; Gradinariu et al., 2004). The method of localized irrigation achieved a fruit production increase of 11.06 kg in comparison with the method of micro irrigation with sprinkler which ensured a growth of 5.18 kg, both methods using 1 m^3 of water (Iancu; Septar, 2009).

Researching every attribute and specific character for complex systems which are biological known and new wants obtained through the process of apricot breeding required specific methods of collecting, processing and interpreting of data.

Considering this, the present work intend to highlight the technological options using localized irrigation and irrigation associated with foliar fertilization on the behaviour of three cultivars of apricot: ´Dacia´, ´Comandor´ and ´Tudor´ grafted on Mirobolan, with different maturation stages, in terms of the South-East of Romania, where optimal culture conditions are found. The three cultivars will be studied under the aspect of certain morpho-productive characteristics and the quality of fruits under the influence of irrigation and irrigation associated with fertilization.

MATERIALS AND METHODS

Obtaining an increase in the production of apricots can be attained through cultivar choice and ensuring adequate hydric needs. The experiment was carried out at the Moara Domneasca – Ilfov research station in 2011-2012 cropping year.

The soil that was founded typical reddish preluvosoil where the experiments began (according SRTS-2012 Chrome Luvisol according to WRB-ST-1998). In table 1 chemical analysis of soil (according Methodology ICPA-1987) are presented, which shows a weak acidic reaction of soil with values ranging from 5.82 to 6.19 (pH units).

Humus content is low (from 1.20 to 2.10%) at the top of the soil (0-72 cm, corresponding to the sequence of horizons Ap-AB), and very low (0.36 to 0.60%) based on the profile (72-150 cm).

Table 1. The main chemical properties of the soil - Moara Domnească

Level	Depth	pH_{H2O}	Humus (Cx1,72)	SB	Ah	T = SB + Ah	V_{Ah}
	Cm	units pH	%	me/100 g soil	%		
Ap	0-16	6.12	2.10	13.61	6.57	20.18	67
Apt	16-29	5.82	1.92	13.39	6.33	19.72	68
Am	29-40	6.19	1.80	15.98	4.30	20.28	79
AB	40-72	6.00	1.20	20.09	2.60	22.69	89
Bt_1	72-93	6.02	0.60	21.09	2.53	23.62	89
Bt_2	93-130	6.04	0.36	22.03	1.70	23.73	93
Bt_3	130-150	6.18	0.36	22.03	1.70	23.73	93

The plantation was established in 2004 with the planting distances of 5 x 4 m.

The following experimental scheme was organized: A factor – cultivar, with graduations: a1=´Dacia´, a2=´Comandor´ and a3=´Tudor´; B factor – norme of irrigation with the following graduations: b1=non-irrigated (control), b2=drip irrigation using a Nestos dripper type with dripping of 4l/hour; C factor - fertilization with Cropmax 0,1% with the following graduations: c1=nonfertilization and c2=fertilization with Cropmax 0,1%.

Drip irrigation was initiated since March 20, administering it daily for 4 hours. During the periods in which rainfall was recorded, irrigation was discontinued.

It has been established as the optimal time periods in which trees are most in need of water, these being: fruit sett, physiological fall, strengthening kernel, intensive growth of shoots and fruit, bud differentiation. The amount of water in watering is about 350 - 400 m^3/ha. The fertilizers were applied 3 times: immediately after blossom and every 2 weeks after. Soil samples were collected at two depths (0-20 and 20-40 cm), variants b1 (unirrigated) and b2 (irrigated) in the 3 cultivars a1, a2 and a3 and analytical data was interpreted according to the methodology ICPA (1986, 1997).

At the end of the vegetation period these measurements where recorded: tree height (m), crown height (m), crown projection through the rows direction (m), crown projection opposite to the rows direction (m), the trunk diameter on the rows direction (cm), the trunk diameter opposite to the rows direction (cm). Based on the crowns dimension these calculations were performed: the crowns volume (m^3) and shape (index) and based on the trunks dimension the trunk sectional area was calculated using specific breeding methods for fruit growing (Cociu, Oprea, 1989).

The crowns form and dimension depend on the cultivars vigour, on the angle of branch insertion, on the type of ramification, as well the length and the position of branches upon the axial branch. The more the angle of ramification is higher the more the diameter of the crown is higher as well.

After the obtained values the crowns shape can be:

- the value is around 1 or below 1 the shape of the crown can be spherical or even flat (<1,0)

-the more the values are higher than 1, higher crown shapes are resulted, reaching all to pyramidal shapes or fusiforme.

The crowns volume can be a particularity of cultivar, which can be influenced by rootstock and agrotechnics applied. Elements of fruit quality were determined by specific methods. The average weight of the fruit (g) was determined by weighing 25 fruits from each experimental variant of composite sample using an electronic balance. The content of soluble dry matter (%) was determined by a Zeiss refractometer using a sample juice resulting from 10 fresh fruits. Titratable acidity (malic acid g%) was determined by direct titration of a diluted extract with an alkaline solution of 0.1N NaOH in the presence of phenolphthalein solution (1% alcohol). Pulp firmness was made by portable penetrometer from a sample size of 20 fruits.

RESULTS AND DISCUSSIONS

Crown volume

Recorded measurements point out that in the VIII year the limits to volume values of the crown was between 5.65 – 9.35 m^3, which can show o high variability regarding the experiment. The cultivar with the lowest volume of crown was ´Dacia´ with differences between experimental studied variables of 5.65 m^3 and 7.10 m^3. The cultivar with the highest volume of crown from the 3 studied cultivars was b2c2 with differences from b1c1Mt cultivar between 1.45 m^3 for ´Dacia´ cultivar, 0.45 m^3 for ´Comandor´ and 0.80 m^3 for ´Tudor´ (Table 2).

Trunk section area (TSA)

Between the experimental studied variants, differences of trunk section was registred of 33.72 cm^2 for ´Dacia´ cultivar, 37.38 cm^2 for ´Comandor´ and 41.35 cm^2 for ´Tudor´ cultivar. For the b1c1Mt variants, the cultivar with the smallest trunk section area was ´Comandor´ (216.67 cm^2), followed by ´Dacia´ (220.48 cm^2) and ´Tudor´ (250.85 cm^2). The experimental variant with the highest growth spur of the trunk section area was b2c2 (Table 2).

Crown shape

The variability attribute given by the crowns shape is present in the index of form and through the valoric limits of these attributes, therefore the crown of ´Dacia´ cultivar is spherical (1.00-1.14), regardless of the experimental factor applied. As well, the ´Comandor´ cultivar through valoric limits of 1.13-1.21 express a spherical form, slightly alongeted, compared with ´Tudor´ cultivar which show a piramidal crown (1.50-1.58) (Table 2).

Table 2. Effect of experimental factors (b1, b2, c1, c2) on the vigor characteristics of apricot cultivars studied

Cultivar	Experimental variant	Crown volume (m^3)	Deference	TSA	Difference	Crown shape (index)
´Dacia´ (a1)	b1c1Mt	5.65		220.48		1.02
	b1c2	6.00	0.35	226.65	6.17	1.03
	b2c1	6.60	0.95	239.63	19.15	1.14
	b2c2	7.10	1.45	254.20	33.72	1.00
´Comandor´ (a2)	b1c1Mt	6.55		216.67		1.20
	b1c2	6.75	0.20	222.78	6.11	1.21
	b2c1	6.85	0.30	249.81	33.14	1.14
	b2c2	7.00	0.45	254.25	37.58	1.13
´Tudor´ (a3)	b1c1Mt	8.55		250.85		1.57
	b1c2	8.80	0.25	269.88	19.03	1.53
	b2c1	9.00	0.45	282.55	31.70	1.58
	b2c2	9.35	0.75	292.20	41.35	1.50

Regarding the characteristic of productivity, a significant difference has resulted between the experimental variants studied, b2c1 from b1c1, for the 3 studied cultivars with differences

between the control variants of 6.25 (´Comandor´), 6.50 (´Tudor´) and 6.75 (´Dacia´). The b2c2 variant expressed a significant difference from b1c2 variant with values between 7.15 (´Tudor´), 8.25 (´Comandor´) and 8.50 (´Dacia´) (Table 3).

Table 3. The influence of drip irrigation levels on the production (t/ha) of apricot for the same cultivar and the same level of fertilization, 2011-2012

Cultivar (a)	´Dacia´ (a1)		´Comandor´ (a2)		´Tudor´ (a3)	
	Production (t/ha)	Dif	Production (t/ha)	Dif	Production (t/ha)	Dif
c1 (unfertilized)						
b1 (unirrigated)	18.75	Mt	17.5	Mt	16	Mt
b2 (irrigated)	25.5	6.75**	23.75	6.25**	22.5	6.5**
c2 (fertilized)						
b1(unirrigated)	21.50	Mt	18.25	Mt	18.75	Mt
b2 (irrigated)	30	8.5***	26.25	8.25***	25.90	7,15***
$DL_{5\%}$=3.499534 $DL_{1\%}$ = 4.924643 $DL_{0,1\%}$ = 7.014573						

Characterization of soil under the aspect of apparent density values (AD) which show the state of alignment (loosening or compaction) can be small and medium on the 0-20 cm layer and once with depth the indicator goes higher.

The lowest values of apparent density resulted from the 0-20 cm layer for the ´Comandor´ cultivar (1.20 g/cm^3) and ´Tudor´ (1.25 g/cm^3) at the experimental variant b1 and the experimental variant b2 the ´Tudor´ cultivar (1.28 g/cm^3) at the same depth. Very high values was observed at the 20-40 cm depth for both experimental variants (b1 and b2) for all 3 studied cultivars (Figure 1).

Regarding soil characterization in terms of total porosity (TP), we emphasize that the parameter values are inversely proportional to the apparent density (AD).

Note that the version b1 of 0-20 cm depth porosity is medium, recording higher values (44.5 to 54.5 % v/v) than version b2 (46 to 51 % v/v) where it is medium.

The same general trend is preserved and the depth of 20-40 cm between versions b1 and b2, with values between 36.5-40 % v/v (b1) and 37.5 to 38.5 % v/v (b2) (Figure 1).

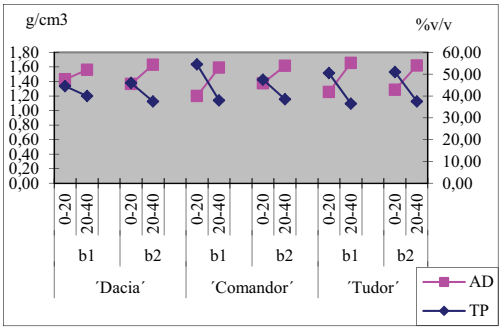

Figure 1. Effect of experimental factors (b1, b2) on the apparent density (AD) and total porosity (TP) of apricot cultivars studied

Available phosphorus values (mobile) shows small assurance for the 2 depths for both experimental variants, only ´Tudor´ cultivar at the 0-20 depth for both experimental variants the level of assurance is medium with 22.84 ppm (b1) and 20.07 ppm (b2) (Figure 2). Appreciation of ensuring soil with K^+ accessible (mobile) was made based on the values obtained for the layer 0-40 cm, values that are within the 25-40 ppm showing a lowered insurance with K (Figure 2).

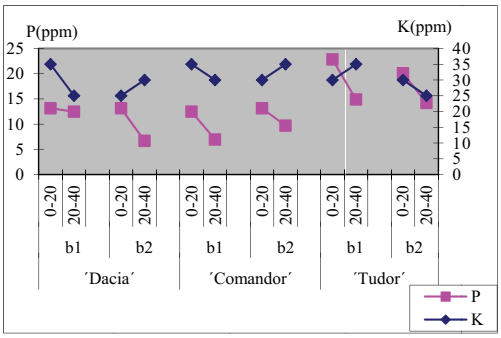

Figure 2. Effect of experimental factors (b1, b2) on the in phosphorus (P) and potassium (K) contents of apricot cultivars studied

The average weight of the fruits grew progressively from application of experimental factors in the following order: fertilization, irrigation and irrigation + fertilization.

´Dacia´ cultivar of b1c1Mt variant had fruits with a weight of 76.5 g and variant b2c2 fruits weighing 90 g ´Comandor´ and ´Tudor´ cultivars had fruits with low weight at b1c1Mt from 59 g to 75-76 g (Figure 3).

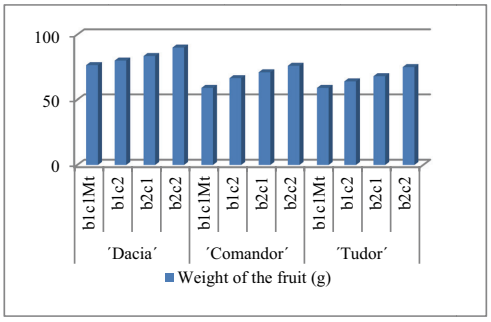

Figure 3. Effect of experimental factors (b1, b2, c1, c2) on average weight of the fruit (g) of apricot cultivars studied

Figure 4. Apricot cultivar ´Dacia´

The dry matter content presented stagnations for b1c2 (fertilized) variant and b2c1 (irrigated) and for b2c2 variant slight increases was registered, the most significant being ´Tudor´ cultivar of 1.6%. The ´Dacia´ cultivar, the difference between b2c2 and b2c1 was of 0.5% and for the ´Comandor´ cultivar just 0.8% (Figure 5).

Titratable acidity (malic acid/g%) presented progressive increase from the b1c1Mt variant to b2c2, the most significant being ´Tudor´ cultivar (0.59) (Figure 6).

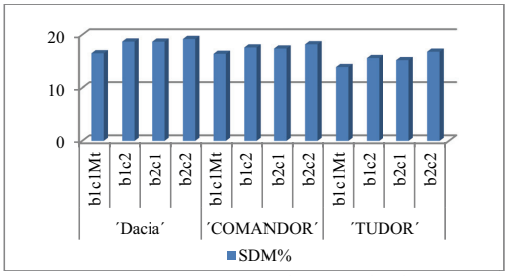

Figure 5. Effect of experimental factors (b1, b2, c1, c2) on soluble dry matter content (%) of apricot cultivars studied

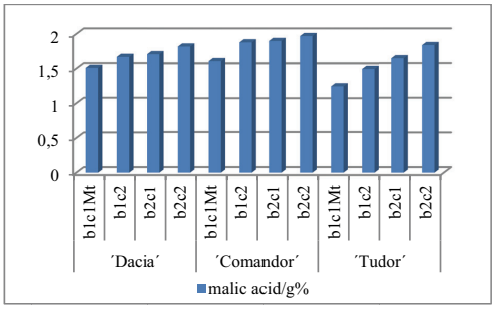

Figure 6. Effect of experimental factors (b1, b2, c1, c2) on titratable acidity content (malic acid/g%) of apricot cultivars studied

Under the aspect of fruit firmness, show in figure, shows that in the control variant that the ´Dacia´ cultivar has fruits with the best firmness (1.82 kgf/cm^2), followed by ´Comandor´ (1.7 kgf/cm^2) and ´Tudor´ with 1.3 kgf/cm^2. Under the aspect of irrigation and fertilization effect (b2c2), a significant increase was recorded for the cultivar ´Tudor´ reaching 2.2 kgf/cm^2 (Figure 7).

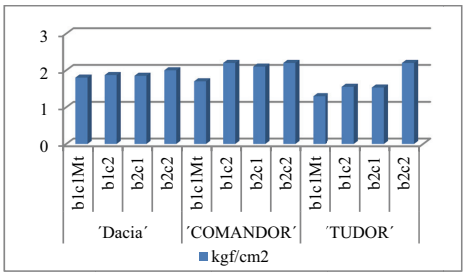

Figure 7. Effect of experimental factors (b1, b2, c1, c2) on fruit firmness (kgf/cm^2) of apricot cultivars studied

Figure 8. Apricot cultivar ´Comandor´

Figure 9. Apricot cultivar ´Tudor´

CONCLUSIONS

• The cultivar with the lowest crown volume was ´Dacia´ with differences between experimental variants studied of 5.65 m^3 and 7.10 m^3.

• Variant b1c1Mt the ´Comandor´ cultivar had the lowest trunk section area with 216.67 cm^2, followed by ´Dacia´ with 220.48 cm^2 and ´Tudor´ with 250.85 cm^2. The experimental variant with the highest growth spur of the trunk section area is b2c2.

• Regardless of the experimental factor applied, the crowns shape show the characheristic of the cultivar ´Dacia´ having a spherical crown (1.00-1.14), ´Comandor´ showing a spherical and slightly alongeted shape (1.13-1.21) and ´Tudor´ which presents a piramidal crown (1.50-1.58).

• Regarding the productivity characteristic, a significant difference resulted between the experimental variants studied, b2c1 for b1c1, for the 3 studied cultivars, with differences from the control between 6.25** (´Comandor´), 6.50** (´Tudor´) and 6.75** (´Dacia´). The b2c2 variant expressed a very significant difference from the b1c2 variant with values between 7.15** (´Tudor´), 8.25** (´Comandor´) and 8.50** (´Dacia´).

• Indicators of soil physical attributes, namely apparent density (ad) which shows the depth values 0-20, growing in depth alongside the percentage of clay in the soil. Regarding soil characterization in terms of total porosity (TP), we emphasize that the parameter values are inversely proportional to the apparent density (AD). Note that the version b1 of 0-20 cm depth, porosity is medium recording higher values (44.5 to 54.5 % v/v) than the version b2 (46 to 51% v/v) where it is medium. The same general trend is preserved and the depth of 20-40 cm between versions b1 and b2, with values between 36.5-40% v/v (b1) and 37.5 to 38.5 % v/v (b2). Soil potassium supply is low which implies the use of fertilizers with K.

• Regarding the elements of quality of the fruits (average weight of the fruit, dry matter content, acidity and firmness) a progressive increase has shown once the application of experimental factors in the following order: fertilization (c2), irrigation (b2) and irrigation + fertilization (b2c2).

REFERENCES

Amiri M.E., Fallahi E., Golchin A., 2008. Influence of foliar and ground fertilization on yield, fruit quality, and soil, leaf, and fruit mineral nutrients in apple, Journal of Plant Nutrition, Vol.31, Issue 3, p. 515-525.

Bertschinger L., Henauer U., Lemmenmeier L., Stadler W., Schumacher R., 1997. Effects of foliar fertilizers on abscission, fruit quality and tree growth in an integrated apple orchard. Acta Hort 448, p. 43-50.

Gradinariu G., Bireescu L., Istrate M., Zlati C., 2004. The influence of foliar fertilization upon apple tree growing and fructification, Lucrari stiintifice USAMVB, Seria B., Vol XLVII, p. 329-333.

Iancu M., Leinar Septar, 2009. Efectele irigării localizate asupra cantităţii şi calităţii producţiei unor soiuri de cais în condiţiile din Dobrogea, Scientific papers of the R.I.F.G. Pitesti, Vol. XXV.

Proebsting E., 1994. In Tree fruit irrigation, Strategy development for managing drought, eds Williams K.M., Ley T.W. (Good Fruit Grower, Yakima, WA), p. 39–50.