

**THE EXPRESSION OF *rin* GENE IN PROLONGATED TOMATO FRUIT
RIPENING (*LYCOPERSICON ESCULENTUM* MILL.)**

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Tomato selection programme, aiming to create a tomato hybrid with better fruit firmness, has been based on adding *rin* gene in perspective selection material. The fruit firmness has been based on decelerated ripening which prolongs the shelf life. Heterozygote genotypes (*rin/+*) have considerably longer shelf life than genotypes with uniform ripening (*+/+*). The effects of *rin* gene on shelf life have been examined on four experimental hybrids (K – 56, K – 18, K – 64 and K – 15 – *rin/+* genetic configuration) compared with Atina F1 genotype (uniform ripening *+/+*) K – 91 selected line (*rin/rin*) and Fino F1 (DRS) unknown genetic construction and very good fruit firmness. The parameter for shelf life has been the fruit weight loss during the preservation – from harvest till the fading. The weight loss has been recorded every 7th day during two months. The experimental hybrids showed good agro technical characteristics of mid early tomato intended for production in the open field. During the shelf life, the genotype K – 15 faded the most slowly, both in the group of green and mature fruits.

Key words: tomato, fruit firmness, shelf life, favorite genotypes

INTRODUCTION

Tomato lines with *rin* gene have been selected for the first time in the Centre for Vegetable Crops. Selection of these lines with good quantity traits, gives the opportunity of creating the F1 hybrids in the way the producers want them, which means: long lasting products of great firmness suitable for long distance transportation and enlarged sale.

Fruit firmness is polygene trait and depends on components of firmness that separately influence the whole trait. The most important components of fruit firmness are: firmness of epidermis, thickness of pericarp and firmness of fruit flesh (YOSHAWA *et al.*, 1982). The firmness of fruit can be increased by accumulating the favorable ratio of traits, separately for each component (ZDRAVKOVIC *et al.*, 2000). Good firmness of fruit, when it comes to the firmness of flesh, can be achieved by using the genotypes with *rin* gene. These genotypes, effect the asynchronization of fruit maturity process, slow down the processes, so the fruits do not get over mature or soft. These fruits stay firm and they are suitable for use as fresh products or for stocking -"shelf life" (GRANGES *et al.*, 1995). Homozygote genes (*rin/rin*) influence the fruit maturity because they block the production of ethylene, decrease carotinoide and lycopene production, so the mature fruits do not turn red (TANKSLY *et al.*, 1998.). Comparing to genotypes with uniformed maturity (+/+), heterozygote gene (+/*rin*) prolongate the fruit maturity up to 10 days. Due to a co-dominant ratio of gene *u* (uniformed maturity) and *rin* gene (ripening inhibitor) the fruits are red, but with delayed maturity. Longer period of maturity of this genotype enables long preservation of fruit after the harvest, so called "shelf life" (BUECHER, 1977).

MATERIJAL AND METHODS

In comparative research, 4 experimental F₁ hybrids (K-56, K-18, K-64 i K-15 – *rin*/+ genetske konfiguracije) and two hybrids (Atina F1 which has uniformed maturity, hybrid Fino F1 DRS with good shelf life period) and one homozygote line (K91-homozygote with *rin* trait) have been used. Experimental combinations were created by crossing the new selected lines from fruit firmness selection cycle and lines than have good combining ability, especially for yield and early ripening. Long-lasting of picked fruits (green and mature), shelf life, has been determined by the number of days from harvest to fall. The mature fruits have been picked up in the period of full coloring of fruits, while for the group of green fruits (45 days from fertilization) we studied the dynamic of ripening, preservation and fall during two months to seven days. The fruit mass loss was expressed with standard deviation, and the fall of fruits was expressed with mass loss from picking to complete fall.

The differences among the studied genotypes within the morphological parameters were expressed with the least significant difference –LSD test (NJEGIĆ *et al.*, 1991).

RESULTS AND DISCUSSION

The modern directions of tomato selection have fruit firmness as an imperative both because of transport as well as for the shelf life in the market. Genotypes *rin/+*, the same as at homozygote, prolongation the fruit ripening, but the expression is less determined comparing to the genotypes that have uniform ripening (TANKSLY *et al.*, 1998).

We studied the shelf life of genotypes with *rin* gene. They have been compared with Atina F1 hybrid which has uniformed ripening. Atina F₁ has been used as a standard for short shelf life, both for mature and green fruits and homozygote for *rin* characteristic K-91, as a standard for long shelf life.

Shelf life is one of the most common characteristics of modern tomato hybrids. Critical time that has been used to evaluate the changes (or fall) of fruits is two weeks because that is considered to be the time when picked fruits come to their final destination. AGAR *et al.*, (1994) have studied the commercial hybrids picked in different phases of fruit ripening and different conditions of fruit preservation and came upon the conclusion that the best preservation of *rin* genotypes is at the temperature of 10°C. Our research has been set up in room temperature of 22°C. In order to determine the limits of endurance of experimental combinations, experiment lasted for a longer period. Genotype with uniformed ripening Atina F1 maintained 7 days after picking up, which is the average value of shelf life of fruits with uniformed ripening in similar studies (GRANGES *et al.*, 1995). Shelf life of *+rin* genotype fruits, that have been picked up in red phase lasted approximately one month (Table 1, Fig. 1.).

Table 1. Mass lost of mature fruits after picking

hybrids term of measured	F1 56 <i>rin/+</i>	F1 18 <i>rin/+</i>	F1 64 <i>rin/+</i>	Atina <i>+/+</i>	Fino F1 unknown	F1 15 <i>rin/+</i>	K-91 <i>rin/rin</i>
27.avg	116	134.6	144.1	98.6	108.7	152	118.6
3.sep	102	122.58	136.7	92.5	103.2	134.4	112.1
11.sep	61.2	123.81	140.9		98.6	142.7	111.1
16.sep		106.28	134.1		94.1	135.76	106.5
24.sep		78.9			79.2	102.8	104.2
1.okt							99.9
8.okt							98.7
15.okt							95.6
σ	28.471	21.696	4.431	4.313	11.212	18.542	7.782

Figure 1 shows the trend of lost of average mass of mature fruits. The incline shows that the loss, of mass is almost the same as for Atina F₁ and Fino F₁ hybrids despite the fact that hybrid Atina F1 did not have long shelf life comparing to Fino F1, witch had one month of shelf life. The line for homozygote K91

(*rin/rin*) and heterozygote K15 (*+/rin*) shows the less lost of fruit mass in shelf life period, although K15 maintained the same as Fino F₁.

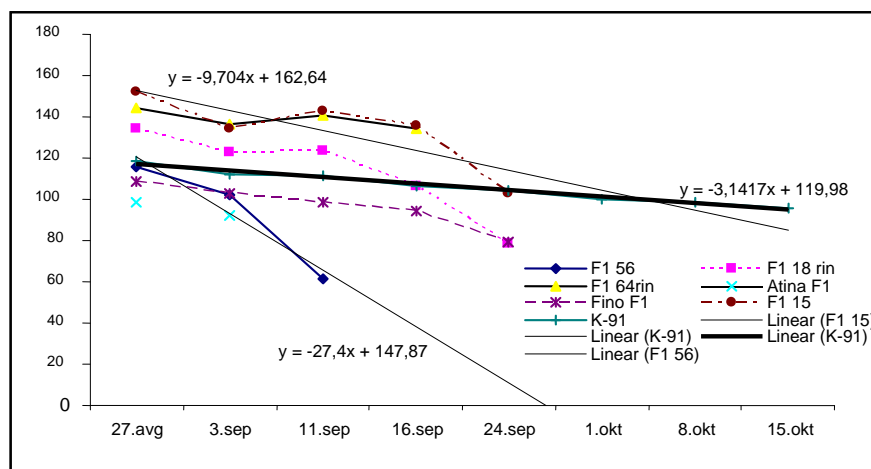


Fig. 1. Mass lost trend of mature fruits after picking, *rin/rin*, *rin/+* and *+/+* genotypes

Green fruits show a little bit different results. The fruits with genotype *+/rin* have been preserved around two months and most of the fruits in different combinations have fallen. (Table 2, Fig. 2). Genotype K91 (*rin/rin*) has been the best preserved and did not have even the first change of the color after a few months. Sporadic fall of fruits has been caused by disease on injured parts, but not because of over-maturity of fruits.

Table 2: Mass lost of immature fruits after picking

Hybrids term of measured	F1 56 <i>rin</i>	F1 18 <i>rin</i>	F1 64 <i>rin</i>	Atina F1	Fino F1	F1 15 <i>rin</i>	K-91
27.avg	109.95	107.3	88.2	105.6	74.1	134.35	91.3
3.sep	106.22	104.2	83.7	101.3	73.1	128.68	87.4
11.sep	104.56	102.55	81.2	101.1	70.3	125.8	84.4
16.sep	103.77	100.54	80.6	99.1	67.3	122.38	81.3
24.sep	98.42	98.43	74.6	75.6	65.6	116.85	79.4
1.okt	97.46	95.12	71.7	74	64.8	118.24	78.2
8.okt	97.06	92.84	65.5		64.4	116.97	76.4
15.okt	76.3	85.06	64.2		62.5	120.37	74.7
22.okt	78.55	83.94	63.3	Decline	64.6	121.58	72.6
29.okt	77.3	82.38	62		62.3	117.38	70.6
5.nov	76.1	84.13	62.3		56.1	119.25	69.9
σ	13.404	9.122	9.670	14.099	5.159	5.563	6.899

The best shelf life had hybrid Fino, K15 and K-18 that survived two months in 60 - 40%.

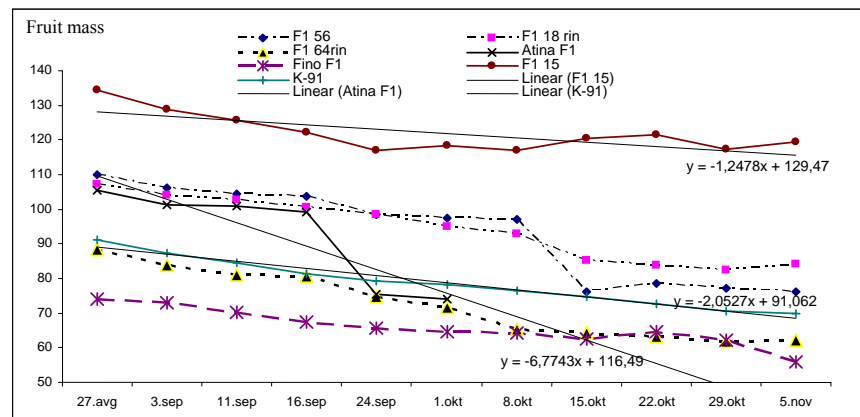


Fig. 2. Mass lost of immature fruits after picking in *rin/rin*, *rin/+* and *+/+* genotypes

CONCLUSION

In order to achieve the aim of the selection, the commercial tomato hybrids with good agronomic characteristics and satisfying firmness of fruits have been selected. Studying the great number of characteristics and comparing them to the commercial hybrids, we can recommend the middle season hybrids K-15 F₁ and K-18 F₁ for using in practice for supported growing in the open field and in plastic houses.

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EKSPRESIJA *rin* GENA NA PROLONGIRANO SAZREVANJE PLODOVA PARADAJZA (*LYCOPERSICON ESCULENTIM* MILL.)

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Izvod

Program selekcije paradajza koji je imao za cilj dobijanje hibrida sa povećanom čvrstinom ploda, zasnovan je na unošenju *rin* gena u perspektivne selekcionarne materijale. Čvrstina ploda koju smo dobili unošenjem ovog gena, zasniva se na usporenom sazrevanju, a time je dobijen duži vremenski period posle berbe (*shelf life*) kada plodovi mogu da preživljavaju. Kod genotipova u heterozigotnom obliku (*rin/+*) period preživljavanja plodova je znatno duži nego kod plodova koji imaju uniformno sazrevanje (*+/+*). Efekat delovanja *rin* gena na »shelf life« ispitivan je na četiri eksperimentalna hibrida (K-56, K-18, K-64 i K-15 – *rin/+* genetske konfiguracije) u komparaciji sa genotipom Atina F1 (uniformno sazrevanje, *+/+*), selekcionisanom linijom K-91 (*rin/rin*) i Fino F1(DRS) nepoznate genetske konstrukcije i dobre čvrstine ploda. »Shelf life« je praćen na osnovu gubitka mase zrelih i zelenih plodova tokom čuvanja – od berbe do konačnog propadanja. Gubitak mase ploda praćen je na 7 dana, tokom 2 meseca. Eksperimentalni hibridi pokazali su dobre agrotehničke karakteristike srednje ranog paradajza namenjenog za proizvodnju na otvorenom polju. U »shelf life« periodu, najmanje je propadao genotip K-15 kako kod grupe zelenih tako i kod grupe zrelih plodova.

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