

# STARCH ACCUMULATION AND FIELD WINTER HARDINESS IN SOME GROUPS OF GARDEN ROSES

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The starch accumulation dynamics in ground cover, climbers, curb and hybrid tea roses during their transition from the growing season to rest was studied and their field winter hardiness was estimated.

**Keywords:** *garden rose, field hardiness, starch accumulation*

Rose is a very old and highly ornamental plant which is often used for decoration of gardens and parks. The main centers of roses origin are in Central and Southeast Asia (China, India) and Southwest Asia (the Caucasus, Iran) from where they were initially introduced to Europe [1].

In terms of Ukraine different types of roses are grown, but the most popular are curb, climbers, hybrid tea roses and ground cover [2]. Due to the danger, during some years of frost damage, it is necessary to improve the resistance of ornamental plants against low temperatures.

Starch is the main reserve carbohydrate of higher plants, which is extremely important for their wintering. It is synthesized in chloroplasts in response to the light during photosynthesis and it varies in different plants through the grains structure, molecular polymerization degree, polymer chains structure and physico-chemical properties. In woody plants and brushwood a considerable amount of starch accumulates in sprouts [3, 4].

It is known that during the autumn-winter period carbohydrate-oil metabolism is crucial in plants. Carbohydrates metabolism protects plants from low temperatures. The large number of carbohydrates at the end of vegetation is an important factor for improving plant resistance against low temperatures. Thus, in autumn starch digestion

and its conversion into sucrose, melitose and partly into oil is observed. In winter-hardy woody plants the starch hydrolysis occurs earlier than in non winter-hardy plants. The earlier and better starch will be hydrolyzed, the more of other substances which provide frost and winter hardiness will be collected in plants tissues. Starch content in different tissues of woody plants is used for the winter and frost resistance of plants diagnosis [5].

**The goal of research** is to study the starch accumulation dynamics in different groups of roses during the transition from the growing season (maximum content) to the rest and to compare it to the rates of field hardiness.

**Materials and methods.** Materials for the research were found among annual sprouts of four groups of roses from the research area of the Landscape Management and Plant Genetics Department of ZNU: miniature (variety Rouletii), rambler (Paul's Scarlet Slimber) hybrid tea (Latin Lady) and ground cover (Swany).

Samples of sprouts 10-30 cm in length were taken from 2-5 plants, depending on the group of roses, and were cut with the help of an electric grinder. Then crushed material was dried in air to dryness. This material was stored in paper bags till the determination of starch.

An amount of starch in annual sprouts was determined by the reaction with iodine in potassium iodide solution [6]. The study was conducted four times in repetitions in August, September and November, 2010 and 2012.

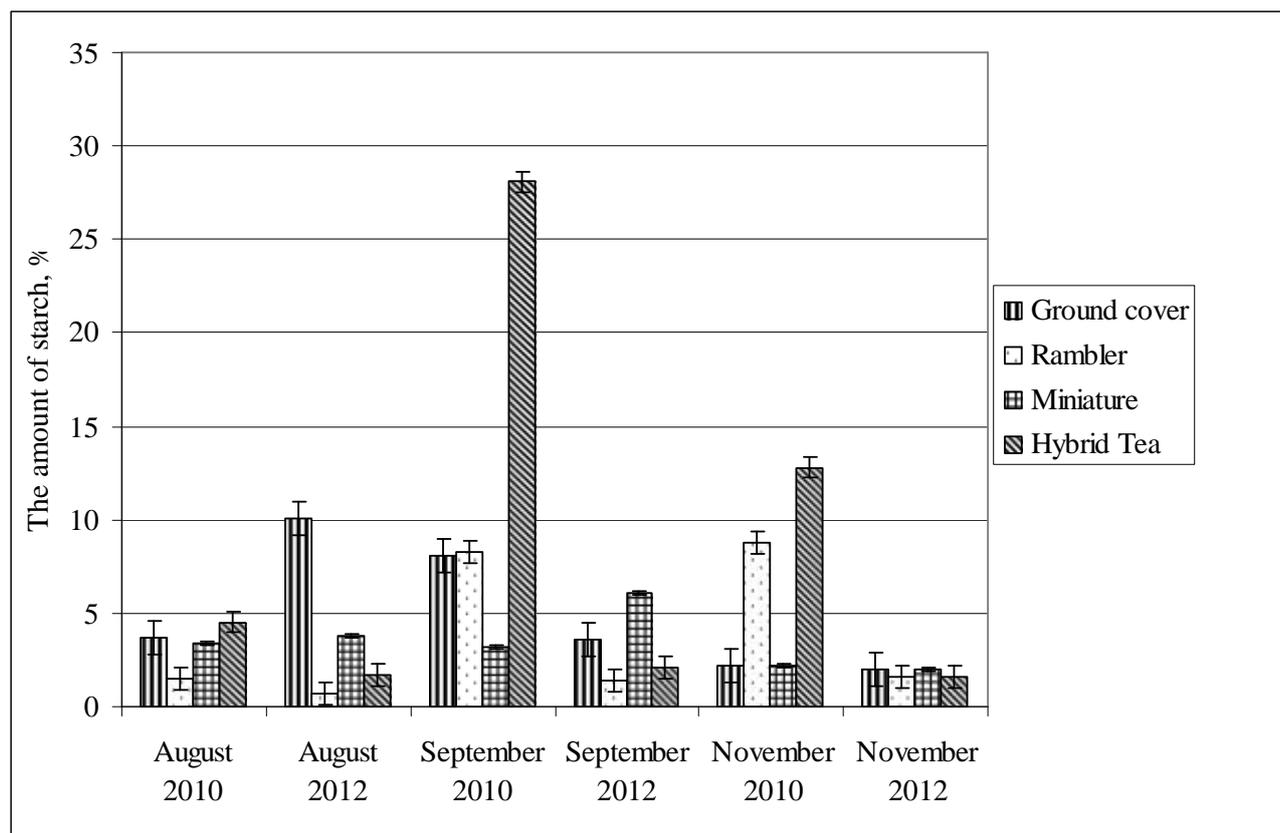
The degree of starch content change from August or September to November were determined according to the formula:  $A - B/A \times 100$ , where A is an amount of starch in August or September, B in November.

The field winter hardiness was estimated in 2011 and 2012 visually in points [7]. The condition of plants after wintering was recorded in April, with the help of camera.

The statistical processing of data was performed according to the conventional methods [8], using the computer program Excel.

**Research results and discussion.** An amount of starch in annual sprouts in all the studied groups of roses during two years significantly changed from August to

November (Picture 1). Besides, usually from August to September a significant increase in its content have been seen, and from September to November there was its reduction. The maximum amount of starch was noted in September in roses of all the groups except ground cover in 2012, which has the highest starch content in August, and the minimum – in November.



**Pic. 1. Dynamics of starch accumulation in different groups of roses from the growing season to rest (2010 and 2012)**

The dynamics of an amount of starch in different samples from the biggest accumulation to its rest, so from August or September to November in 2010 and 2012 years is shown in Table 1. According to the table, the degree of change in starch content was different. So, from September to November in 2010, this index for ground cover rose was 71.95%, while for curb it was only 33.3%, for hybrid tea it dropped almost twofold, and for rambler it has not changed.

In 2012, the period of maximum starch accumulation in ground cover roses, as

opposed to other groups, was in August, and to November the starch content decreased almost fivefold. Comparing to other groups of roses the degree of change in starch content for the ground cover roses was the biggest and worked out over 80%, while for the miniature and hybrid tea rose accordingly it was 67 and 25%. Like in 2010, an amount of accumulated starch in rambler roses in September did not decrease in November.

**1. The dynamics of starch content in different groups of roses during the growing season – rest (2010 and 2012).**

Groups of roses	Starch content in annual sprouts of roses, %				The degree of change in starch content, %	
	During the growing season (August-September)		During rest (November)		2010	2012
	2010	2012	2010	2012		
Ground cover, Swany	8,2±0,90	10,1±2,19	2,3±0,13	2,0±0,17	71,95	80,19
Rambler, Paul's Scarlet Climber	8,4±0,59	1,4±0,18	8,9±0,13	1,6±0,26	-5,95	-14,28
Miniature, Rauletii	3,3±0,11	6,1±1,88	2,2±0,11	2,0±0,17	33,3	67,0
Hybrid Tea, Latin Lady	28,2±0,56	2,1±0,45	12,9±0,86	1,6±0,30	54,25	25,16

After the wintering 2010/2011 ground cover rose woke with the best result, and it has a bit frosty annual sprouts (Table 2, Picture 2). In roses of the other three groups it was noted a significant freezing of preceding years sprouts, and even a freezing of them to the root collar. Winter of 2011/2012 ground cover rose also passed with the best result, it had only a bit frosty past years sprouts. But curb and hybrid tea rose

sprouts were frozen to the root collar. So, we can say that in Zaporozhye region ground cover roses survive the winter better than rambler, miniature and hybrid tea.



**Pic. 2. The condition of ground cover (left) and miniature (right) roses after wintering (April, 2011)**

## 2. Field winter hardiness of different groups of roses.

Groups of roses	Level of freezing, degrees	
	2011 year	2012 year
Ground cover, Swany	4-5	3
Rambler, Paul's Scarlet Climber	2-3	2
Miniature, Rauletii	3	2
Hybrid tea, Latin Lady	2-3	2

**Note: 5 – freezing is absent, all buds blossom on sprouts; 4 – slight freezing of annual sprouts or separate buds; 3 – freezing of preceding years sprouts; 2 – freezing of sprouts to the root collar; 1 – plant died.**

## Conclusions

1. While studying the dynamics of starch accumulation in ground cover, rambler, miniature and hybrid tea roses during their transition from the growing season to rest,

its amount in annual sprouts of all the samples significantly changes from August to November, however, the degree of these changes is different. The biggest decrease of starch content occurred in ground cover rose, when rambler rose did not have it at all.

2. Rates of field winter hardiness in 2010/2011 and 2011/2012 years of researches shows the better ability to winter in ground cover rose comparing to hybrid tea, miniature and rambler roses, which is consistent with the dynamics of starch accumulation during the transition from the growing season to rest.

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## **НАКОПИЧЕННЯ КРОХМАЛЮ І ПОЛЬОВА ЗИМОСТІЙКІСТЬ У ДЕЯКИХ ГРУП САДОВИХ ТРОЯНД**

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Вивчена динаміка накопичення крохмалю в ґрунтопокривної, виткої, бордюрної та чайно-гібридної троянд під час переходу рослин від вегетації до періоду спокою та оцінена їх польова зимостійкість.

*Ключові слова:* садова троянда, польова зимостійкість, накопичення крохмалю.

## **Накопление крахмала и полевая зимостойкость у некоторых групп садовых роз.**

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Изучена динамика накопления крахмала у почвопокровной, вьющейся, бордюрной и чайно-гибридной роз при переходе растений от вегетации к периоду покоя и оценена их полевая зимостойкость.

*Ключевые слова:* садовая роза, полевая зимостойкость, накопление крахмала.