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CICHORIUM INITIAL SELECTION MATERIAL CREATION AND FOR HETEROSIS SELECTION IN FOREST-STEPPES CONDITIONS OF UKRAINE

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It is shown Chicory Root (Cichorium intybus L. var. Sativum Lam.) initial forms evaluation results by the main agronomic signs. It is discussed Chicory Root importance and it's potential as a new industrial culture. Because materials selection basic collection learning by the yield, dry matter content and inulin was elucidated, that productivity indicators and inulin content and dry matter content did not depend on the samofertylnyh progenies number, which gives grounds to recommend selected genotypes as a starting material for samoplidnyh materials, followed by combining ability assessment to Chicory Root heterotic hybrids output.

Keywords: dry matter content, yield, heterosis hybrids, agronomic characteristics, inulin, Cichorium intybus L. var. sativum Lam.

Chicory Root *(Cichorium intybus L. var. Sativum Lam.)* as an industrial culture for inulin production is grown in Western Europe mainly and a lesser extent in other parts of the world [1, 2]. Inulin belongs to fruktaniv linear β (2,1)-type, which is widely used as a probiotic with antioxidant properties [3]. In Ukraine, Russia, Belarus Chicory Root began to cultivate only in the prewar years. In Ukraine, the sown area is accounted more than 3.5 hectares, and in the world - more than 70 thousand hectares [4, 5].

In Ukraine until recently the Chicory Roots grain processing products, as in other former Soviet republics, used primarily as a coffee additive to partially overcome the deficit and to reduce the drink cost. Today is an independent and highly demanded product, which remains an essential component in the natural coffee (16-20%) production, tea and coffee drinks (70%), also used in the candy, cookies, cakes, beer and so on manufacture. Chicory Root value determined by the inulin content in the roots, fructose, and intybin and tsykoreol. Since time immemorial Chicory is widely used in folk medicine for diabetes treatment, liver, stomach, kidneys, heart, nervous and other diseases. Conventional medicine is recognizes the plants medicinal value and that on base were processed chicory products and created more than 40 drugs. Paris Medical Laboratory investigations was found that the chicory root is contain 33 elements, and vitamins A, E, C, B2, B12, PP. Chicory leaves contain a

high carbohydrates amounts and therefore is a valuable nutritious juicy fodder for agricultural animals. [6].

Chicory Root is a valuable raw material for fructose production - an indispensable attribute of baby food, and pectin. Chicory is well as in the candy, cookies, cakes, beer and so on manufacture. This is why it is highly valued in the world market [4, 7].

Despite on chicory growing great economic value and economic benefits the areas under these valuable plants are small. Chicory root crops appeal for agricultural producers is somewhat understated because the great complexity and a large share of manual labor in growing, especially during roots harvesting. Modern agricultural production in dire is need new Chicory Root domestic varieties and hybrids, that combining high yield and chemical-technological quality with root form suitable for mechanical harvesting [6], and adapted to the soil and climatic conditions of Ukraine. [8].

At the end of last and beginning of this century Chicory Root selection was revived in Uman experimental breeding station of the Institute of bioenergy crops and sugar beet NAAS of Ukraine. Here was developed the crops modern scheme selection, including creating raw materials, and obtaining new varieties and seeds modernized ways [9].

As a result of intensive selection process were established by hybridization method between sample collection and nursery repeated individual selection and included in the State Register of Plant Varieties of Ukraine a number of chicory Root varieties: Umanskyy-90 with elongated root crop, Umanskyy, 95, Umanskyy -97, Umanskyy -99 with conical root form, Umanskyy - 96 with cylindrical root form [10].

Countries with developed industrial production are requiring large energy amounts. However, their security in each country is different. Most countries, including Ukraine, import energy from abroad. In order to reduce dependence on imported energy is searching renewable energy. Today more than 50 countries are legally supporting the renewable energy sources development, alternatives to traditional fossil fuels seeking. One alternative is biological fuels species. Given the importance of renewable energy sources chicory is holding great perspectives for using in fithoenergetics as a valuable raw material for ethanol production. It is able to provide 3200-3300 l/ha of ethanol. According to this index chicory is far outstrip winter wheat (2700-2800 l/ha) and is closing to the potatoes (3500-3600 liters per hectare). However, in order to achieve the desired results in chicory Root as raw materials for ethanol use is necessary to conducting the large breeding improving work with the culture, to create varieties that would roots yield at the level of 48,0-54,0 t/ha and inulin high content [11].

The research relevance is based on chicory roots and their products unmet demand in the domestic market and significant perspectives to reach them on the foreign markets and the need to ensure new source material breeding programs.

Research Methodology. It was researched formed Chicory Root materials selection basic collection in Uman experimental breeding station of the Institute of bioenergy crops and sugar beet NAAS of Ukraine, which included a number of foreign varieties and varieties and inbred lines of their own selection, total number, in 2005-2010 was 487-516 rooms. In 2011-2013 it was selected in the previous years by

the complex of agronomic traits of plants first (productivity, solids content, and in particular, inulin, etc.) and plants characteristics in the second vegetation year, especially seed productivity and its components (productive stems number, the number of flowers on new growth and the plant, the flowering of a flower and whole plant) varieties examples mentioned collection was evaluated by major economically useful traits of plants the first growth year in the collection and breeding nurseries.

Chicory Root genotypes yields estimated was determined by continuous collecting them by hand each day and weighing all of roots from each plot after carefully cleaning them of soil residues [12]. The field germination was evaluated by the IBKiTsB method [13]. Also determine the emergence dynamic after germination to full stairs, the roots and leaves mass growth dynamics and sugars accumulation in the roots, which every decades since from the second decade of July to early September, were taken from each plot in three reps of 20 root samples. Preharvesting density was set by plants counting in two meters intervals in diagonally areas by IBKiTsB methodology [12]. Experimental data statistical analysis was carried out by R. Fisher variance analysis [14].

Research results and their discussion. During 2008-2009 from the Chicory Root materials basic selection materials collection were selected 114 best roots which in 2009-2010 were planted for breeding and plants traits evaluation complex in the second vegetation year, especially seed productivity and resistance to powdery mildew and tsercosporosis, in isolated areas.

It was observed flowering one plant duration considerable variation, number of seeds from one plant and number of seeds from a single inflorescence. Among the finest selected in previous years by roots mass and seeds breeding productivity numbers were formed two breeding nurseries, which included varieties examples with different susceptibility to facultative inbreeding.

In order to receive new inbred lines of varying depth was used inbreeding method various schemes. In conducting selfing was having trouble seeds tying. With its pollination with one flower pollen - tying is not the case at all. In the some flowering shoots isolation or part of some genotypes tied seed, but it was low quality and germination. The best results were obtained in the entire plant isolation. Seeds tied 7-10% of different biotypes plants.

Given the fact that chicory root crop most varieties are characterized by greater compared to wild halfculturic numbers and genetic collections tendency on inbred seeds tying and development could include the breeding possibility for this plant fertility. Thus, according to A. Yatsenko [8] on isolated plants of the vegetation second year Umanskyy 90, Umanskyy 95, Umanskyy 97 varieties under the isolators (per plant) seeds tied in 27.9, 27.2 and 29.1% of plants, respectively. Instead of offspring selected for seed productivity variety example these plants were from 14.7 to 56.1%, significantly higher than in our experiments.

This led to experiments conducting on fertility level influence on the chicory Root first vegetation year plant productivity signs. It is for this indicator was formed two breeding nurseries, the first of which included the offspring that were less than 10, and the second those in which the number of fertility offspring exceeded 10%.

It was found that the fertility level was little impact on productivity (Tables 1 and 2).

Table 1. **Root chicory plant source material characteristics in the first breeding nursery (2011-2012)**

Field number	Root yield, t/ha	Inulin content, %	Dry matter content, %	Inulin yield, t/ha	Dry matter yield, t/ha
C-60	39,8	18,6	23,4	7,4	9,3
C-61	40,6	18,3	22,9	7,4	9,3
C-62	39,5	18,2	23,1	7,2	9,1
C-63	39,7	18,2	23,5	7,2	9,3
C-64	39,5	18,4	23,8	7,3	9,4
C-65	40,6	18,5	23,7	7,5	9,6
C-66	39,2	17,7	22,7	6,9	8,9
C-67	39,8	17,9	23,4	7,1	9,3
C-68	39,7	18,3	23,1	7,1	9,2
C-69	39,0	18,4	22,6	7,2	8,8
C-70	39,1	17,9	23,0	7,0	9,0
C-71	39,2	18,1	23,8	7,1	9,3
C-72	39,6	18,0	23,4	7,1	9,3
C-73	40,3	18,6	22,9	7,5	9,2
C-74	39,7	18,3	23,1	7,3	9,1
C-75	39,5	18,2	23,2	7,2	9,1
C-76	40,6	18,2	23,6	7,4	9,6
SSD_{05}	0,20	1,00	0,78		

In the nursery of initial breeding material with low level fertility progenies research three variety examples were significantly higher than average yields. These were C-61, C-65 and C-76 selection numbers. The inulin content was allocated in C-60 and C-73, but the deviation from the average nursery as well as the difference between the best and worst inulin content numbers were within SSD_{05}, indicating that the fluctuations are insignificant and significant dependence of this parameter from the weather conditions. So in 2012, in all variety example researching inulin content was at 1,0-1,4% higher than in 2011, while having lower variability limits compared with the previous year.

Table 2. Root chicory plant source material characteristics in the second breeding nursery (2011-2012)

Field number	Root yield, t/ha	Inulin content, %	Dry matter content, %	Inulin yield, t/ha	Dry matter yield, t/ha
C-80	39,5	18,0	23,6	7,11	9,32
C-82	40,3	18,3	23,5	7,37	9,47
C-83	40,0	17,9	23,6	7,16	9,44
C-84	40,1	18,1	23,2	7,25	9,30
C-85	39,8	18,4	23,4	7,32	9,31
C-86	39,9	18,6	23,8	7,42	9,49
C-87	39,6	18,2	23,5	7,20	9,30
C-88	40,2	18,5	23,4	7,43	9,40
C-89	39,8	18,4	23,6	7,32	9,39
C-90	40,5	18,3	23,6	7,41	9,55
C-91	39,7	17,9	23,5	7,10	9,32
C-94	40,2	18,3	23,4	7,35	9,40
C-95	40,5	18,4	23,5	7,49	9,51
C-96	39,8	18,5	23,7	7,36	9,43
SSD_{05}	0,20	0,74	0,30		

In the nursery with initial breeding material research with higher fertility progenies significantly exceeded the average yield breeding C-90 and C-95numbers. However, physical indicators of average yield (40.5 t/ha) were differed little from the breeding materials average yield with low fertility progenies (40.6 t/ha). Inulin content, then (as in the previous nursery) the difference between the best and the worst over the inulin content numbers were within SSD_{05}. Weather conditions dependence was similar also.

Combining ability estimation, which was held in polykross (2011) and topkross (2012) crossings did not provide highlight hybrid combinations that could form new hybrid heterosis the basis. All selection materials were researched, regardless the fertility progenies number was showed combining ability average levels. In the hybrid progenies was not observed a significant increase in root productivity and quality. This result can be explained by the source material affinity that is created on UDSS. In 2013For heterosis effect, as parental components were used collectible specimens introduced from Russia and Poland, resulting in a hybrids number were obtained with enough seed, all of which will be done as follows.

Conclusions. All Chicory Root genotypes researched had relatively high productivity, while inulin content was also high, and solids content ranged from medium to high, regardless the fertility progenies number, which gives grounds to selected genotypes recommend as a starting material for cross material, followed by combining ability evaluation to Chicory Root heterotic hybrids output.

Source material new genotype is creating, that will provide heterosis effect when hybridization is advisable to use inbred lines and collectable designs from Russia and Poland.

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