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ŠAURLAPU LUPĪNAS SELEKCIJAS PERSPEKTĪVAS (*Lupinus angustifolius* L.) ZAĻMASAS AUDZĒŠANAI

Maknickienė Z.

Šaurlapu lupīnu selekcijā Lietuvas Zemkopības institūta Vokes nodaļā tiek izmatota individuālā selekcijas metode kopš 1993, kad tika iegūta kolekcija no N. Vavilova Viskrievijas Augu Rūpniecības institūta. Laika periodā no 1995. – 2005. tika selekcionētas divas šaurlapu lupīnu šķirnes, kas paredzētas zaļmasas ražošanai - VB Derliai un VB Ugniai, kā arī divas lopbarības šķirnes - VB Vilniai un VB Antaniai. Šķirnes VB Derliai, VB Ugniai un VB Vilniai iekļautas ES Augu Šķirņu katalogā 2006.-2007. gadā. Laika posmā 1995. – 2005. ir izveidotas ne tikai iepriekšminētās šķirnes, bet arī piecas šaurlapu lupīnu līnijas izgājušas visas selekcijas procesa pakāpes un tika izvērtētas saskaņā ar starptautiskiem standartiem. Visām piecām selekcijas līnijām konstatēta augsta izturība pret sēņu slimībām, ātrs augšanas temps visās augšanas stadijās, augsta sēkļu raža (2.1–2.9 t ha⁻¹), īss veģetatīvās augšanas periods (82-98 dienas). Tās ir vērtīgs materiāls no ģenētikas, selekcijas un agronomijas viedokļa. Līnijas var tikt izmantotas tālākā lupīnu selekcijas programmā bet vērtīgākās līnijas tiks nodotas oficiālām pārbaudes iestādēm.

THE EVALUATION OF BUCKWHEAT HYBRIDS FOR THE INHERITANCE OF VALUABLE AGRONOMIC FEATURES

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Abstract

Buckwheat (*Fagopyrum esculentum* Moench.) breeding work has been done at the Voke Branch of the Lithuanian Institute of Agriculture during 2004 – 2007. The general idea of buckwheat breeding was to create high yielding, big size grains and short stem buckwheat cultivars. Buckwheat varieties are bred using hybridization, massive and individual selection methods. The selected best buckwheat genotypes were assessed evaluating grain yield and size, plant stability and the ability to lie flat and other valuable biometric features.

The main aim of this research work was to explore buckwheat hybrid seedling phenotype inheritance. The general idea of buckwheat breeding was to create high yielding, big size grains and short stem buckwheat cultivars. Trials were performed with 144 hybrid numbers. 40.0 – 47.6% the selected hybrids had big sized grain and short stem inheritance. Buckwheat inheritance consistent patterns have a great influence in the breeding work for big size and short stem buckwheat cultivars.

Key words: buckwheat breeding, buckwheat features inheritance, new buckwheat hybrids

Introduction

Buckwheat is one of the main cereal plants grown on the light soils in Lithuania. Traditionally they are used in the food industry as well as in pharmacy and the chemical industry (Пироговская, 2000). The land area for buckwheat covers over 21000 ha in Lithuania (Batulevičiūtė, 2006). The economical importance of buckwheat increases every year as more and more attention is given to human health problems. Due to this buckwheat scientific research work and the breeding of new buckwheat varieties has started to increase on the world wide level (Campbell, 2003).

Improvement programs for buckwheat varieties have existed now for over a hundred years. But yield and other quality feature changes were small in comparison with other crops. Buckwheat is a cross pollinated plant, but also self pollination is possible. But self pollinated grain is inefficient and plant production from such seeds is low (Савицкий, 1970).

The main aim of the research work at the Voke Branch of the Lithuanian Institute of Agriculture was to explore buckwheat hybrid phenotypes and their valuable farming features such as grain size and plant height inheritance in the breeding process for high yielding, big size and resistant to low flat varieties during the 2001-2004 research years.

Materials and Methods

The experimental plots were established on sandy loam on carbonaceous fluvial-glacial gravel eluviated soil (IDp), according to FAO-UNESCO classification *Haplic Luvisols (LVh)*. Soil agrochemical characteristics: pH_{KCl} 5.2 – 6.2, humus – 2.11 – 2.18%, mobile P₂O₅ 108 – 152 mg kg⁻¹, mobile K₂O 150 – 165 mg kg⁻¹. Soil for buckwheat trials was ploughed in the autumn, cultivated twice and harrowed in the spring. Fertilization – N₆₀P₅₀K₄₀. Herbicide – agroxone 750, 1,6 l ha⁻¹ was applied after buckwheat sowing. Test field area for collection trials – 2 m², for competitive varieties trials – 12 m² in 4 replications. Planting rate – 3 mln ha⁻¹ of fertile seeds. Buckwheat is a short vegetation period plant. The growing period is June, July and August. So summer meteorology conditions have the most important influence on buckwheat growth and development. During the research June meteorology conditions were unfavourable for buckwheat plant growth till the bud stage and flowering start. Because of high rainfall and low air temperature 2004 was a very bad year for buckwheat and also because of drought in 2006. Meteorology conditions data are presented in 1 Table.

The buckwheat flowering period and grain formation physiologically proceed at the same time – from the end of June till mid September, but the most intensive period is July. Buckwheat ripens about one month from the beginning of the flowering period, so for yield formation July and August are very important months. During the research (2004 and 2005) the July months were dry (hydrothermic coefficient HTK 0.87 and 0.70), but 2007 had higher rainfall (HTK 4.22). Meteorology conditions during August of 2004-2006 were unfavourable for buckwheat growth because of high rainfall and in 2007 due to drought.

Buckwheat varieties are bred using hybridization, massive and individual selection methods. Selected buckwheat hybrid numbers 1000 grain mass and plant height was compared with parent plants in accordance with the coefficient of phenotype domination *hp*: *hp* < -1.0 – negative hyper domination, -1.0 < *hp* < -0.5 – partial domination of lower index, -0.5 < *hp* < 0.5 – no or low domination, *hp* > 1.0 – full heterosis (Волотович, 2006). The phenotype domination coefficient *hp* was calculated in accordance with the formula:

$$hp = \frac{(F_1 - MP)}{(P_{max} - MP)}$$

*F*₁ – hybrid features value

MP – parent's features mean value

*P*_{max} – parent parent's with the higher characters display feature value

According to the phenotype domination coefficient four hybrids groups were evaluated:

- I. 20 hybrids, bred in 2001.
- II. 20 hybrids, bred in 2002.
- III. 53 hybrids, bred in 2003.
- IV. 51 hybrids, bred in 2004.

Results and Discussion

The buckwheat breeding program was created with varieties and hybrids consisting of the valuable agronomic features. 4 buckwheat varieties were used for the crosses: Volma, Zaleika, Zniajarka, VB Vokiai with the hybrids, selected during the research work. During the research work 144 buckwheat hybrids were selected and tested. The buckwheat selected according to the phenotype domination coefficient, and valuable farming features from parent plants inherited hybrids, are explored in the second and third groups. Results show that 50% of the hybrids, selected in 2002, inherited big size grain and 60% – short stem. Data results are presented at Fig. 1 and Fig. 2. In the third group 60.4% of the hybrids inherited big size grain features. In the first group, the buckwheat hybrids selected in 2001 had weaker valuable agronomic features: domination was found only in 10% of the plants, so there was no heterosis effect. Most buckwheat hybrids in the fourth group had an intermediate size and short stem inheritance.

Buckwheat plants have one of the longest flowering periods and produce a high number of flowers. But compared with other cereals buckwheat yield is usually lower. So the most important way to increase buckwheat yield is to select productive varieties.

Buckwheat breeding data results show that 2001 hybrids did not inherit large seeds. About 80% of the tested hybrids had small grain and there was no heterosis effect (Fig. 1). It was determined that buckwheat selection for large grain size is one of the main measures in new variety breeding, because of polymorphism domination inheritance (Алексеева, Паушева, 1988; Анохина, 1990). Grain size which has 1000 grain weight is one of the most important buckwheat variety features. But it can vary depending on growing conditions. For example, the trial data of 2000-2001 gave 1000 grain mass – 32.2 g to the variety VB Vokiai (Almantas, 2002). But during the 2001-2004 period the conditions for plant growing were extreme, so 1000 grain weight was lower – 31.0 g (Romanovskaja, Ražukas, 2006). Buckwheat breeding trials performed at the Voke branch of Lithuanian Institute of Agriculture data show that 1000 grain mass variation was very low. The varieties variation coefficient was 0.5 – 5.7%, hybrids 1.0 – 6.5% (Romanovskaja, Ražukas, 2006). Buckwheat hybrids plant height inheritance evaluation data of the first group show that 70% of the tested hybrids had heterosis (Fig. 2). Selected hybrids did not inherit short stem height. Multiple populations were produced during the first two years of the breeding work, in 1999 and 2000. The mother plants were selected as hybrid numbers and the foreign varieties as father plants. First year hybrids were used as the primary material for the new cultivar breeding. The buckwheat hybrids of 2002 – 2004, the parental crossings were eliminated and the higher hybrid numbers inherited big size grain and low plant height up to 60% (Fig. 1 and Fig. 2). In the fourth group the hybrids received after crossings with the Lithuanian variety VB Vokiai and the best hybrids of 1999 – 2001 were tested. Evaluating buckwheat hybrids valuable farming features and evaluating the phenotype domination coefficient it was determined that the hybrids which had intermediate big size grain inheritance dominated. An 39.2% of the hybrids had such an inheritance type (Fig. 1). Low height parental plants were chosen for the crossing combinations, which have genetic features for earliness and resistance against the plants lying flat. For example, the Lithuanian variety VB Vokiai is of low height, the average stem height is 87 cm and even in the wet seasons plants are not high (Almantas, 2002; Romanovskaja, Ražukas, 2006). The greatest number of 2004 buckwheat hybrids were taller than the parental plants. 39.2% of the tested hybrids had the heterosis effect (Fig.2). Low plant height was inherited by more than one third of the selected hybrids – 37.3%.

Research results show that choosing low height varieties and hybrids for the new low height varieties the planned results can not always be obtained because of the heterosis effect. But most of all the new bred varieties had lower than medium height, less than one meter.

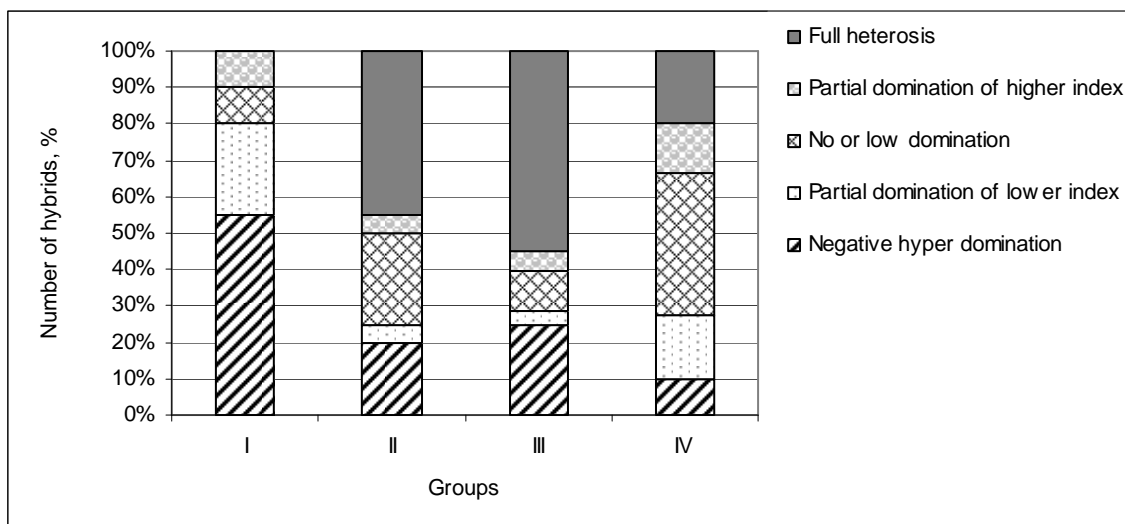


Figure 1. Hybrids inheritance estimation of 1000 grain weight (Trakų Vokē, 2004 – 2006)

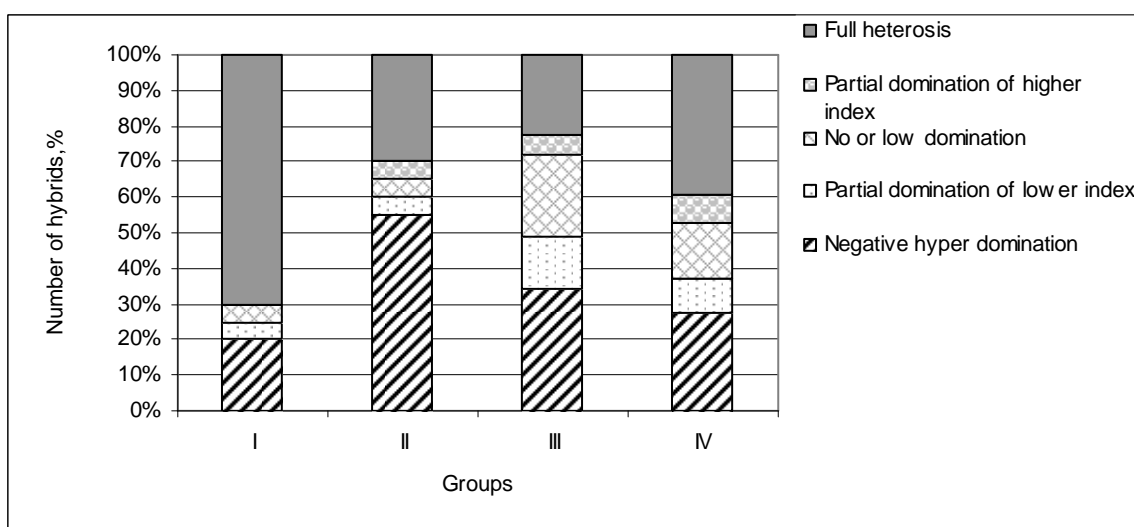


Figure 2. Hybrids inheritance estimation of plant height (Trakų Vokē, 2004 – 2006)

Estimating the last three years research results, when parental crosses were eliminated in the buckwheat breeding work, the data show that 47.6% of the inherited big grain size hybrids and low stem height – 46% of the hybrids. Research of the buckwheat hybrids quantitative features evaluation show that by choosing the right parent plants good results can be achieved in big size grain productive buckwheat varieties breeding.

Conclusions

The buckwheat breeding program performance for the selection of big size grain and low height plant varieties demonstrated that 46.0 – 47.6% of the selected hybrids inherited the most valuable inheritable features. Using the parent crossing breeding method, only 10% of the buckwheat hybrids inherited big size grain feature and 25% – low plant height. The inheritance of the most valuable agronomic features was very low.

144 buckwheat hybrids were tested during the six research years. Very important genetic material was collected for further buckwheat breeding and research work. The buckwheat hybrids quantitative features consistent pattern will be of great significance for the breeding of new big size grain and low plants height buckwheat varieties.

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NOZĪMĪGU AGRONOMISKU PAZĪMJU IEDZIMŠANAS IZVĒRTĒJUMS GRIĶU HIBRĪDIEM

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Laika posmā no 2004 līdz 2007.gadam Lietuvas Zemkopības institūta Voke filiālē veikta griķu (*Fagopyrum esculentum* Moench.) selekcija. Galvenās griķu selekcijas metodes ir: iekšsugu hibridizācija, masu un individuālā izlase. Labākajiem atlasītajiem genotipiem tiek vērtēta graudu raža, augu garums, sēklu lielums un citas agronomiski nozīmīgas pazīmes.

Galvenais pētījuma mērķis bija novērtēt, kā griķu hibrīdiem iedzimst dažādas agronomiski svarīgas pazīmes. Galvenais selekcijas mērķis ir izveidot augstražīgas, īsstiebrainas griķu šķirnes ar rupjām sēklām. Izmēģinājumā vērtētas 144 hibrīdās kombinācijas. Rupji graudi un īss stiebrs iedzima 46.0 - 47.6% hibrīdu. Saistītai rupju sēklu un īsa stiebra iedzimšanai hibrīdos ir nozīme griķu selekcijā, jo iespējams iegūt šķirnes ar iepriekšminētajām pazīmēm.

VARIATION OF POTATO MERISTEM CLONES - NEW FACTS FOR SCIENCE AND PRACTICE

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Abstract

In vitro regenerated plantlets obtained through the virus-eradication procedure were preserved as meristem clones *in vitro*. The progeny of each meristem was the basis for the meristem clone. The agronomic traits of meristem clones were evaluated in field trials. The late blight resistance of meristem clones was determined on the *in vitro* level, where the plants were inoculated with a pure culture of *Phytophthora infestans* and as well as in the field. More than 600 meristem clones of 40 varieties were studied over a long period of time. The results showed that meristem clones differed in their yield, starch content and disease resistance. For example, the yield of 16 meristem clones of the variety Agrie Dzeltenie varied from 32.4 to 51.4 t ha⁻¹ as an average during the three trial years. The one meristem clone of the variety Bintje was superior to the others for a higher resistance to late blight, for yield and for starch content. For the variety Ants there was no clear correlation between susceptibility to late blight and yield. The most resistant meristem clone produced a yield of 38,1 t ha⁻¹ and the moderately susceptible clone – 51.8 t ha⁻¹. We can conclude