Original scientific paper

PRELIMINARY RESULTS OF TESTING BLUE LUPIN (*LUPINUS ANGUSTIFOLIUS* L.) IN SERBIA

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Summary: Contemporary breeding programs on blue lupin, such as the one that is carried out in the Saatzucht Steinach GmbH in Bornhof, Germany, are aimed at the improvement of tolerance to abiotic and biotic stress and certain morphological and physiological changes. Although blue lupin is almost completely unknown in Serbia a recently launched breeding programme on white and blue lupins in the Institute of Field and Vegetable Crops in Novi Sad provided encouraging results on the introduction of these two species in the country. A small-plot trial was carried out on a pseudogley soil at the Experiment Field of the Dr. Đorđe Radić Secondary School of Agriculture in Kraljevo. In comparison with all other cultivars, the cultivar Bolivio produced a significantly higher grain yield (3005 kg ha^{-1}) at the both levels of 0.05 and 0.01, while the lowest grain yield was in the cultivar Boruta (1425 kg ha^{-1}).

Key words: blue lupin, grain yield, grain yield components, pseudogley

Introduction

Blue lupin (*Lupinus angustifolius* L.), also known as narrow-leafed lupin, is one of the most significant among the lupin species and an important grain legume in many regions of the world (Angelova & Kitcheva, 2002). It has been used as a forage crop and green manure from the time immemorial, while its improvement as a grain legume took place relatively recently, resulting in the development and wide production of the so-called sweet cultivars, that is, with low alkaloid content, in the countries such as Australia, South Africa, Chile and Poland (Cowling et al., 1998).

Contemporary breeding program on blue lupin, such as the one that is carried out in the Saatzucht Steinach GmbH in Bornhof, Germany, are aimed at the improvement of tolerance to abiotic and biotic stress and certain morphological and physiological changes. Along with a higher tolerance to Anthracnose (*Colletotrichum lupinii*) and the development of genotypes that do not reject newly formed pods and with non-shattering pods, one of the most important goals of such programs is the improvement of tolerance to high pH values of diverse soil types (Eckardt et al., 2006). This has an essential and a strategic significance in increasing the growing area of this species, since blue lupin is regarded as not tolerant to calcareous soils with high pH values of more than 7.4, in a rather similar way to other lupin species (White & Robson, 1989; Duthion, 1992), mainly due to lack of micronutrient availability, especially iron (Eickmeyer et al., 2004).

Although blue lupin originates from the Mediterranean center of diversity (Zeven & Zhukovsky, 1975), it is rather little known or, even, completely unknown in Serbia (Mišković, 1986), with no official data on its growing area or production. On the other hand, a recently launched breeding program on white and blue lupins in the Institute of Field and Vegetable Crops in Novi Sad provided encouraging results on the introduction of these two species in the country, with a great progress in growing white lupin on chernozem soils in the northern Serbian Province of Vojvodina (Mihailović et al., 2007).

The chief objective of the study was to determine the possibility of growing blue lupin on acid soils in Serbia, as well as to assess the potential of six advanced blue lupin cultivars grain yield in such conditions.

Materials and methods

A small-plot trial was carried out on a pseudogley soil at the Experiment Field of the Dr. Đorđe Radić Secondary School of Agriculture in Kraljevo. The trial included six blue lupin cultivars developed in the Saatzucht Steinach GmbH, namely Boruta, Boltensia, Boregine, Bora, Borlu and Bolivio.

All six cultivars were sown by hand on April 20 with a plot size of 5 m^2 and at a crop density of about 100 viable seeds m^{-2} (Vučković, 1999). The soil conditions during the growing period of blue lupin are given in Table 1.

Table 1. Agrochemical analysis of the pseudogley soil in Kraljevo during 2006

pH (H_2O)	N (%)	P_2O_5 (mg 100^{-1} g^{-1})	K_2O (mg 100^{-1} g^{-1})	$CaCO_3$ (%)	Humus (%)
4,79	0,13	7,20	11,00	0,00	2,56

There were determined plant height (cm), number of pods ($plant^{-1}$), number of grains ($plant^{-1}$), thousand grains mass (g) and grain yield (kg ha^{-1}). All six cultivars were harvested on July 26. The analysis of grain yield components, that is, plant height, number of pods, number of grains and thousand grains mass, was based upon the samples taken immediately before harvest, while grain yield was measured after the harvest at the moisture level of 14 %.

The results of the study were processed by analysis of variance (ANOVA), with the Least Significant Difference (LSD) test applied, and using the computer software MSTAT-C.

Results and discussion

Plant height. The average plant height in six blue lupin cultivars ranged from 41 cm in Boruta to 53 cm in Boltensia and Bolivio, with significant differences at the levels of both 0.05 and 0.01 between some of them (Table 2). Plant height was generally lower than the species average, mainly due to a rather late sowing (Erić et al., 1996).

Number of pods. The cultivar Bolivio had a significantly greater number of pods (5.7 plant^{-1}) at the level of 0.05 in comparison with all other cultivars except Boregine. The cultivar Boltensia had the smallest number of pods (2.0 plant^{-1}).

Number of grains. In a similar way to number of pods, the cultivar Bolivio had a significantly greater number of grains (21.7 plant^{-1}) at the both levels of 0.05 and 0.01 in comparison with all other cultivars, while the smallest number of grains was in the cultivar Boltensia (9.0 plant^{-1}).

Thousand grains mass. With a variation of between 140 g in Boregine and 190 g in Boltensia, there were no significant differences in thousand grains mass between the six examined blue lupin cultivars. Despite the late date of sowing, it can be considered that all six cultivars produced grains of an average size (wukić, 2002).

Grain yield. In comparison with all other cultivars, the cultivar Bolivio produced a significantly higher grain yield (3005 kg ha^{-1}) at the both levels of 0.05 and 0.01, while the lowest grain yield was in the cultivar Boruta (1425 kg ha^{-1}).

Table 2. Grain yield and grain yield components in blue lupin cultivars in 2006 in Kraljevo

Cultivar YîxbB	Plant height Visina biljaka (cm)	Number of pods (plant^{-1}) *Broj biljaka (biqka^{-1})*	Number of grains (plant^{-1}) *Broj zrna (biljka^{-1})*	Thousand grains mass *Masa hiljadu zrna* (g)	Grain yield Prinos zrna (kg ha^{-1})
Boruta	41	3.3	10.3	153	1425
Boltensia	53	2.0	9.0	190	1634
Boregine	46	4.7	11.3	140	1457
Bora	49	4.0	14.3	152	2062
Borlu	50	4.0	12.0	177	1989
Bolivio	53	5.7	21.7	153	3005
$LSD_{0.05}$	5	1.6	4.5	51	508
$LSD_{0.01}$	8	2.1	6.2	74	698

Conclusions

Although the results on the performance of blue lupin on pseudogley soils were obtained during only one year, they can be considered rather encouraging, especially due to the fact that, despite late sowing, all six cultivars produced both grain of normal size and yields as high as in traditional grain legumes of the region. Future research on blue lupin in Serbia should be aimed at the further testing of grain yields in diverse environments, as well as at the possibility of its utilisation as forage crop and green manure.

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