Screening New Legume Species for Use as Cover Crop in Southern Germany

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Abstract

A screening among more than 800 accessions, belonging to more than 100 species was performed in the frame of an international cooperative research program from 2012 to 2016. Aim of the screening was, to identify new species and suitable accessions, suitable as cover crops and living mulches in Mediterranean, temperate and more continental climates. In this contribution, results obtained in southern Germany are reported, focusing on potential new cover crops. Several new cover crop species could be identified, which were characterized by high biomass production ad weed suppression, as well as by good seed production. Both species and accessions with early and late growth cycle could be identified.

Introduction and objectives

Aim of the screening was, to increase the range of available legume species, both to be used as cover crops and for living mulches. The range of available legume cover crop species is very restricted, while the agronomic properties of hundreds of species of potential interest are completely unknown. More than 800 accessions of over 100 species, mostly originating from Mediterranean countries, were tested in Germany, Morocco, Italy and the UK in the frame of an international cooperative project. The main criteria of the screening were high biomass production, fast establishment after seeding, high winter hardiness, good weed suppression, and a potential for seed production in commercial scale. Both early and late flowering and maturing genotypes may be useful, according to the respective use, e. g. living mulch, cover crops preceding winter crops, or cover crops preceding late or early spring crops. In this contribution, we report selected results on species potentially suitable as cover crops in temperate climates, such as in southern Germany.

Methods

The screening comprised the following steps: (1) Seed propagation in the greenhouse and taxonomic identification (2) Testing in small, unreplicated plots (2013, 2014) (3) Testing for biomass (dry matter) production, seed production, winter hardiness, disease susceptibility and weed suppression in replicated plots (2015, 2016, 2 and 4 replications, resp.) at Freising, southern Germany on a sandy loam soil.

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Results and Discussion

Several previously neglected species could be identified, which have a potential for use as green manure or cover crop, developing as much or more biomass than the commercial cultivars of vetch used as control. The highest levels of biomass production, but also the highest variability could be observed in the genera *Lathyrus* and *Vicia*, followed by *Trifolium* (Fig. 1). Several species of *Vicia* and *Lathyrus* performed as well or better than Spring vetch cv. Bernina, one of the few varieties available in Germany (Fig. 2). The biomass production of *L. ochrus* and *L. clymenum* was particularly high.

Sufficiently high seed production and the possibility of mechanical harvesting are essential conditions for the establishment of new crop species. The main factors affecting mechanical harvestability were seed shattering, lodging, and unequal ripening. While the seed yield of *Lathyrus ochrus, L. sativa* and *L. clymenum* was surprisingly high (150-300 g/m²) compared to the control (150 g/m²), seed yield of the control (150 g/m²) was as high or higher than that of most other *Vicia* species, indicating that there has been selection for seed yield. Further assessments (data not shown) revealed, that several species of the genera *Vicia* and *Lathyrus* outcompeted all annual weeds almost completely. Use of suitable cover crops will therefore contribute to reduce the use of herbicides or to improve minimum tillage systems for Organic Farming. Moreover, a range of phenological types, from very early to late-flowering species could be identified.

We could show, that there is a great potential to increase the range of available cover crop species, based on wild or hardly domesticated species. Selection of ecotypes would be the best strategy for variety development, rather than breeding.

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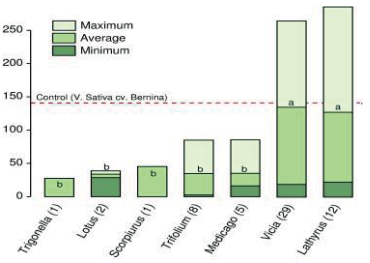

Figure 1: Biomass production of different legume genera at Freising, southern Germany in 2015. Different letters indicate different means (t-test p<0.05)

Figure 2 (below): Biomass production of *Vicia* and *Lathyrus* species at Freising in 2015. Values outside the dotted lines are significantly different from the control (Tukey HSD-Test, p<0,0)