

Short Communication

## CREATING AND CHARACTERISATION OF NEW RED CLOVER VARIETY 'JANCIS'

Biruta Jansone, Sarmīte Rancāne<sup>#</sup>, Pēteris Bērziņš, and Aldis Jansons

LLU Research Institute of Agriculture, Zemkopības inst. 7, Skrīveri, LV-5125, LATVIA;  
sarmite.rancane@inbox.lv

<sup>#</sup> Corresponding author

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*The aim of this work was to develop a red clover variety adapted to agro-climatic conditions of Latvia, suitable for different requirements of forage producers, resistant to most widespread diseases and producing high seed yield annually. Medium late ripening diploid red clover variety 'Jancis' was created at the LLU Research Institute of Agriculture in long-term work carried out since 1985. After free pollination of best samples of red clover collections from the VIR (St. Petersburg), individual and family selection among hybrids were carried out for approximately 20 years. Finally, best breeding line Nr. 43047 was registered as a variety 'Jancis'. The variety is characterised by good winter hardiness, high dry matter yield (10–12 t·ha<sup>-1</sup>) and good persistence in the sward — up to 3–4 years. The variety is characterised by a long stem (90–110 cm) with 8–9 internodes, dark green leaves with a distinctive brighter picture, medium length and width of medial leaflet, and bright pink flower heads. 'Jancis' has stable annual seed yield in the conditions of Latvia; under favourable conditions reaching 500–600 kg·ha<sup>-1</sup> seeds. Since 2010, the variety 'Jancis' has been included in the common Latvian and EU Plant Variety Catalogue.*

**Key words:** *Trifolium pratense*, breeding, yield, morphological traits.

The extension of cropland area of legumes, red clover included, is a high priority task of agriculture not only in Latvia, but also in many countries of the world. The solving of this task gives an opportunity to maintain and improve the soil fertility, to produce valuable fodder cheaper, and to reduce the production and usage of the expensive nitrogen fertiliser. The *Trifolium* genus is very large, as it is represented by more than 300 species. Among them, red clover (*Trifolium pratense* L.) is economically the most valuable and widely cultivated in Latvia, because it is adapted to a wide range of climatic conditions, soil types, fertility levels, land-use patterns and management. The optimum temperature for growth of red clover is between 20 and 25 °C (Bowley *et al.*, 1984). Red clover is an important forage legume and an excellent soil improvement crop grown in temperate regions throughout the world (Taylor and Smith, 1980; Colgecen *et al.*, 2011).

In Latvia, red clover was introduced at the end of the 18<sup>th</sup> century, and in the second half of the 19<sup>th</sup> century it was already grown in almost every farm. The red clover breeding activities in Latvia were started in 1913, when about 300 samples of different origin red clover were sown at Priekulī Plant-breeding and Research Station under the guidance of agronomist J. Lūke (Holms, 1992). Since 1956, the breeding of red clover has been continued at the Research Institute of Agriculture (RIA) in Skrīveri. Red clover samples of

local origin were evaluated and the heterosis effect of inter-variety hybrids was studied. By freely crossbreeding of different red clover varieties, high-yielding hybrid plants could be obtained, which were superior than plants of the parent varieties. Thanks to active cooperation with the All-Union Institute of Plant Industry (VIR) in St. Petersburg and the All-Union Livestock Farming Institute in Moscow, a red clover collection with accessions of wide geographic origin was established. In Skrīveri, breeding activities were performed both with diploid and tetraploid varieties. Selection of tetraploid forms from diploid varieties started in 1972.

Diversity of source material to a large extent provides background for the success of breeding; therefore the right choice of source material is of great importance in the breeding. Genetically varied source material of red clover can be of different origin: wild clover populations, landraces, local and foreign commercial varieties created by using different breeding techniques, genetic populations, and artificial mutants (Jansons *et al.*, 1985). Red clover is naturally a short lived perennial plant and a great effort of breeders is given therefore to increase its resistance to cold and to enhance its persistence. Most plants die in the third or fourth year of sowing (Abberton and Marshall, 2005). The use of more persistent varieties would lead to reduced requirements of nitrogen fertilisers, increased forage yield and quality, as well as to extended intervals between red

clover seeding into sod (Komarek *et al.*, 2007). The aim of breeding is to offer to consumers varieties with high potential of adaptation, which are able to function effectively in different types of soil, form a spacious photosynthetic surface quickly, are competitive in fighting weeds for growing space and nutrients, can produce high and stable yield of biomass and seeds, and that are also winter hardy, perennial and resistant to diseases and pests. Combining these traits, we can create an universal variety suitable for various growing conditions and resistant to potential biotic and abiotic stresses.

In 1985, the study of medium late diploid red clover varieties source material was started in the crop rotation fields of Research Institute of Agriculture, where a source material (collections) nursery was established with 200 varieties and other accessions received from various scientific institutions, mainly from the VIR. In 1988, six best accessions corresponding to a middle-ripening clover type with high dry matter yield, good winter hardiness, good forage quality, stable seed yield and disease resistance were grown isolated in a hybridization nursery to enable them to freely mutually pollinate. Hybrid seeds were sown in the offspring nursery. Plants were evaluated according to the mentioned traits; plants with characteristics not corresponding to breeding goals were eliminated. In 1995, after three years of repeated selection, the best offsprings were grown in the sampling nursery. Elite plants were analysed both in field and laboratory conditions and plants with higher percentage of leaves, winter hardiness, resistant to diseases and with higher seed yield were selected. Further, these plants were sown in a family nursery and compared with the parent plants. The family Nr. 43047 was found as the best among tested families in regard to steep, big bush leaves, a high number of stems per plant and high seed yield. In 2001, after multiplication, the prospective breeding sample was included in the previous variety testing, where it showed better winter hardiness and productivity, in comparison with the standard variety and other tested samples. In 2004, breeding sample Nr. 43047 was included in the competition variety testing, where it performed as the best regarding winter hardiness, high dry matter and seed yield among other varieties cultivated in Latvia. In 2006, the sample as a new prospective variety 'Jancis' was submitted for VCU (Value for Cultivation or Use) and DUS (Distinctness, Homogeneity and Stability) testing. Since 2010, the variety 'Jancis' has been included in the common Latvian and EU Plant Variety Catalogue.

During the long-term breeding and testing of red clover variety 'Jancis', meteorological conditions were greatly different. Rainy summers, warm winters and formation of ice crust under the snow cover caused in some years unfavourable conditions for the wintering of red clover. Nevertheless, various climatic conditions helped to choose the most winter-hardy and resistant samples. Experience with the creation of the variety 'Jancis' showed that one of the methods for developing a variety with high seed productivity was repeated multiple bio-morphological selection of plants

that can form seeds also in unsuitable agro-climatic conditions.

**Variety description.** The variety 'Jancis' is a medium late diploid variety. Under cover crops in the sowing year, red clover plants mostly form a leafy rosette, but without cover crops the sown plants may also create generative shoots. In the first year of use after the beginning of vegetation it grows quite well, after mowing it grows relatively slowly, and during the vegetation period two cuttings can be harvested. The beginning of flowering usually is in the 3<sup>rd</sup> decade of June, when it is a perfect time to start preparing fodder. The vegetation period (from the beginning of regrowth in spring till the phase of seed maturity) lasts 120–130 days.

The height of plant of the variety 'Jancis' is 90–110 cm and its shoots are characterised by 8–9 internodes. The plants are well foliated (leaf proportion in the sward is 42%), they have dark green leaves with a distinctive brighter picture on them, and their flower heads are bright pink. Dry matter yield on average is 11–12 t·ha<sup>-1</sup>. The variety is suitable for universal use — hay, silage, and pasture. A characteristic feature of the breed is forming a stable seed yield annually in Latvia conditions — on average 300–400 kg·ha<sup>-1</sup>, but under very favourable conditions, over 600 kg·ha<sup>-1</sup> can be obtained.

Among medium late clover, including the variety 'Jancis', the necessary sum of active temperatures for maturity of seeds is 1500–1600 °C, which fully corresponds to the climatic conditions of Latvia (average 1800 °C). The variety overwinters well, it is relatively resistant to devastating diseases of clover (*Sclerotinia trifoliorum*, *Fusarium* etc.). It remains well in mixture in the second and in the third year of use, too.

After creation of the new variety, it was described by red clover descriptors and evaluated in the variety comparisons in the RIA experimental fields with average soil parameters: loamy sand soil,  $\Sigma KCL$  5.9–6.2, organic matter content 18 g·kg<sup>-1</sup>, plant available P<sub>2</sub>O<sub>5</sub> – 132.0 mg·kg<sup>-1</sup>, and K<sub>2</sub>O – 86.0 mg·kg<sup>-1</sup> of soil. Before the establishing of trials, 300 kg·ha<sup>-1</sup> of complex mineral fertilisers (5:10:25) with micro-nutrients were applied. Mechanical weed control was performed.

During the period from 2007 till 2010, 12 diploid (2n) red clover breeding accessions and varieties were evaluated by using red clover descriptors. Each accession was sown in three replicates in two 2 m long rows, 60 cm between the rows. The data in this article focuses on four diploid varieties of different earliness: 'Stendes vēlais II', 'Dižstende', 'Jancis' and 'Skrīveru agrais', which was chosen as a standard. Sowing was carried out in May. In autumn of sowing year, some phenological observations were conducted. In spring of the 1<sup>st</sup> and the 2<sup>nd</sup> year of use, winter hardiness and regrowth intensity were estimated, phenological phases, dry matter yield (DMY), and seed production were determined, and other morphological traits were observed ac-

cording to the red clover descriptors. The assessment was made using a 9-point scale.

From 2009 till 2011, the new variety 'Jancis' was evaluated in varieties comparisons that included red clover varieties from the Baltic States (Latvia, Lithuania, Estonia) and Sweden. 'Jancis' was ranked in the early and medium clovers group of six diploid varieties. The sowing of clover was done manually as drill-sowing (15 cm), one plot area of 10 m<sup>2</sup>, with seeding rate 15 kg·ha<sup>-1</sup>. The trial design was a randomised complete block with three replications. Different phenological observations were performed, and winter hardiness, DM yield etc. were evaluated. The varieties were evaluated for crude protein (CP) (LVS EN ISO 5983-2: 2009), acid detergent fibre (ADF) (LVS EN ISO 13906: 2008), and neutral detergent fibre (NDF) (LVS EN ISO 16472: 2006). The experimental data were statistically analysed by applying standard programmes of Microsoft Excel: standard deviations calculated and descriptive statistics methods used.

Altogether 19 traits were evaluated using UPOV and IPGRI descriptors (Anonymous, 1984; 1985). The key indicators are summarised in Table 1. The intensity of regrowth in spring is good and medium after the first cutting. In normal conditions the plants reach 90–95 cm height on average, but in years that are cool and rich in rainfall, the length can reach 100 cm. The number of stems for separately growing plants can exceed 40–50, but the plants in denser sowing have 8–12 stems. The medium-late variety 'Jancis' gives two harvests of full value. As 'Jancis' is a typical medium late variety its 1<sup>st</sup> cutting yield is better (evaluated by 8 points) than the 2<sup>nd</sup> cutting yield (evaluated by 5 points), re-

Table 1

CHARACTERISATION OF VARIETY 'JANCIS' AND SOME OTHER RED CLOVER VARIETIES GROWN IN LATVIA, ACCORDING TO DESCRIPTORS EVALUATED IN 2007–2009

Characteristic	Jancis	Skrīveru agrais	Dižstende	Stendes vēlais II
Winter damage (1 – few; 9 – much)	1	1	1	2
Regrowth intensity after 1 <sup>st</sup> cut (1 – slow; 9 – fast)	5	9	5	3
Length of stem (1 – short 2 cm; long 100 cm)	8	6	8	9
Length of central leaflet (1 – short; 9 – long)	8	5	8	9
Width of central leaflet (1 – narrow; 9 – wide)	7	5	6	9
Number of internodes (3 – few; 9 – many)	7	5	7	9
Beginning of flowering (1 – very early; 9 – very late)	5	2	5	8
Lodging resistance (1 – very low; 9 – very high)	6	8	6	3
DMY of the 1 <sup>st</sup> cut (1 – very low; 9 – very high)	8	8	8	9
DMY of the 2 <sup>nd</sup> cut (1 – very low; 9 – very high)	5	7	5	2
DMY, dry matter yield				

Table 2

PRODUCTIVITY AND SWARD QUALITY OF VARIETY 'JANCIS' AND SOME OTHER RED CLOVER VARIETIES GROWN IN LATVIA (2010–2011)

Variety	Dry matter yield, t·ha <sup>-1</sup>			Winter-hardiness (1–9)*	Crude protein in DM, %	Acid detergent fibre, %	Neutral detergent fibre, %
	1 <sup>st</sup> year	2 <sup>nd</sup> year	average of 2-year data				
Jancis	11.4	6.9	9.2	7.0	18.6	25.53	32.9
Marita	11.8	6.4	9.1	6.3	21.1	26.88	36.4
Vyciai	14.6	5.8	10.2	5.3	16.9	27.67	36.6
Sw Ares	12.1	5.9	9.0	6.0	18.3	23.53	34.2
Dižstende	12.6	8.1	10.4	5.7	17.2	29.00	37.6
Stendes agrais	12.4	5.7	9.1	5.5	17.6	25.66	35.5
LSD <sub>0.05</sub>	2.1	1.8	1.8	1.9			

\*Evaluated in scale (1–9): 1 – very poor; 9 – very good

gardless of climatic conditions. The lodging resistance of the variety is evaluated as medium (6 points). The variety 'Jancis' is diploid, but it is characterised by quite large leaves, and therefore the length of leaves is assessed by 8 points and the width by 7 points. The variety has also a characteristic distinctive picture on the leaflets. Winter damage assessed at 1 point suggests that in winter there is little damages.

Yield is a complex feature that forms gradually and depends on the soil as well as on the climatic conditions in the period of vegetation. The average yield of red clover varieties for two years (2010–2011) is summarised in Table 2. In the first year of use, high dry matter yield (DMY) (11.4–14.6 t·ha<sup>-1</sup>) was obtained from all clover varieties. In the second year of use the DMY of many varieties decreased by almost a half and only 5.7–8.1 t·ha<sup>-1</sup> DMY was obtained. In two years of use the variety 'Jancis' produced 9.2 t·ha<sup>-1</sup> DMY on average. The variety was distinguished among the others by better winter hardiness (7 points) and the quality of DMY — crude protein content was 18.6%; acid detergent fiber (ADF) 25.53% and acid detergent fibre (NDF) 32.9%.

Variety comparison results showed that the variety is productive and winter hardy, so it remains well in the mixture in the second and third year of use. The quality analysis of DM shows that the variety sward has a high protein content and relatively lower acid detergent fibre (ADF) and neutral detergent fibre (NDF) content, providing high-quality forage.

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## SARKANĀ ĀBOLIŅA ŠĶIRNES 'JANCIS' IZVEIDOŠANA UN TĀS RAKSTUROJUMS

Darba mērķis bija izveidot Latvijas agroklimatiskajiem apstākļiem piemērotu sarkanā āboliņa šķirni, kurā apvienota augsta ražība, ziemcietība, ilggadība, izturība pret slimībām, augstvērtīga lopbarības kvalitāte, un kura nodrošina stabilu sēklu ražu ieguvī arī mazāk labvēlīgos klimatiskajos apstākļos. Sarkanā āboliņa šķirne 'Jancis' izveidota LLU Zemkopības zinātniskajā institūtā kolekcijas izpētes rezultātā, veicot brīvapputes hibrizāciju labākiem kolekcijas paraugiem. No iegūtajiem hibrīdiem tika izdalīta perspektīva ģimene Nr. 43047. Veicot ilgstošu atkārtotu individuālo un ģimeņu izlasi, izveidota šķirne 'Jancis'. Tā ir vidēji vēlīna diploīda sarkanā āboliņa šķirne, kas parasti sāk ziedēt jūnija 3. dekādē. 'Jancis' raksturojas ar labu ziemcietību ilggadību, ražību un augstu sausnas lopbarības kvalitāti. Sausnas ražas līmenis sasniedz  $12 \text{ t} \cdot \text{ha}^{-1}$ , stublāju vidējais posmu skaits ir 8,5. Šķirne izceļas ar augstām sēklu ražām — vidēji  $400 \text{ kg} \cdot \text{ha}^{-1}$ , bet pareizas agrotehnikas un labvēlīgos klimatiskajos apstākļos var pārsniegt  $600 \text{ kg} \cdot \text{ha}^{-1}$ . Šķirne piemērota universālai izmantošanai — sienam, skābsienam, ganībām. Kopš 2010. gada tā ir iekļauta ES un Latvijas Augu šķirņu kopējā katalogā.