Improvement of Rose Clover Winter Forage Production

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ID #14-09

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Abstract

Rose clover (*Trifolium hirtum* All.) is a winter annual forage legume that has potential for increased use in the U. S. southern region. New cultivars of rose clover are needed with the combination of cold tolerance, winter forage production and full bloom date of late April. Crosses were made between two early flowering cultivars and one late flowering rose clover cultivar. The F_2 and F_3 generations from these crosses were evaluated in northeast Texas for winter growth, cold damage and date of flowering. Fourteen F_3 lines, out of 37 selected F_2 parents, showed large increases (>100%) in plant size on 9 Feb., relative to the late flowering rose clover parent.

Keywords: Rose clover, cold tolerance, flowering, breeding, selection

Introduction

Rose clover is a self-pollinated winter annual forage legume. Commercial cultivars of rose clover include 'Hykon', 'Kondinin', 'Monte Frio' and 'Overton R18'. Hykon and Kondinin are Australian cultivars and both have very little winter dormancy or cold tolerance. Monte Frio is a cold-tolerant cultivar developed in California. Overton R18 rose clover was released in 1991 by the Texas Agricultural Experiment Station, and was selected for a high level of cold tolerance and improved forage production (Smith et al., 1992). This cultivar is a single plant selection from a mixed PI line introduced from Spain.

Overton R18 has survived winters and been productive in central Oklahoma and in some years southern Kansas and southern Missouri. However, Overton R18 is probably more cold tolerant and more winter dormant than is needed for northeast Texas climatic conditions. Overton R18 reseeds well and is cold tolerant in Old World bluestem (*Bothriochloa* spp.) pastures in the Southern Great Plains (Volesky et al., 1995). In this study, two-month-old seedlings of Overton R18 survived record Oklahoma low temperatures in December with minimum temperatures reaching -27 C. In the same study, plant counts 3 and 4 years after the initial seeding averaged 22 plants/m^2 for rose clover, compared to 3 plants/m^2 for vetch.

A rose clover with less winter dormancy and better cool-season forage production than Overton R18 is needed. This reduction in winter dormancy must be balanced with enough cold tolerance to survive the winter season in the U. S. southern region.

Materials and Methods

Hand crosses were made between Overton R18 and Hykon or Kondinin. Actual crosses were

identified using a leaf mark gene and seed were produced of four F_2 families. Seed of the F_2 families were germinated and plants grown in the greenhouse for six weeks. In mid Nov. 1994, 150 plants of each F_2 population and 50 plants each of the three parent cultivars (750 total plants) were transplanted to a field site near Overton, Texas. The plants were grown in rows with each plant on a 4-ft. center. Lime and fertilizer were applied prior to transplanting according to soil test recommendations. Plant size was measured on 3 Feb. and 10 Mar. 1995 Flowering notes were taken at weekly intervals on each plant beginning 20 Mar. Flowering was rated using the following scale: early bud = bud diameter <. 25 inch; bud = bud diameter >. 25 inch but no open flowers; early flowering = some open flowers noted but <50% of the flowering stems with open flowers; full bloom = >50% of the flowering stems with open flowers.

Seed of 37 selected F_3 lines and four check cultivars of rose clover were germinated and plant grown in the greenhouse for seven weeks. In mid-December 1995, a minimum of 11 plants (actual number ranged from 11 to 28) of each line was transplanted into a dormant bermudagrass (*Cynodon dactylon* [L.] Pers.) sod near Overton, Texas. The plants were grown in rows 4 ft. apart with 1 ft. between plants in rows. Entries were arranged in a completely random design with 5 plants from each entry grouped in a row. Lime and fertilizer were applied prior to transplanting according to soil test recommendations. Plant size was measured and cold damage recorded on 9 Feb. 1996. Cold damage was reported as percent of plants in an entry that exhibited moderate to severe leaf damage due to cold injury. Stand loss due to cold damage was evaluated on 12 April 1996.

Results and Discussion

F_2 Evaluations, 1995. All Hykon and Kondinin plants reached full bloom during the two-week period of 20 Mar. to 4 April. Hykon was slightly earlier to flower than Kondinin. Overton R18

reached full bloom during the 6-day period of 26 April to 2 May. On 27 Mar., Overton R18 was vegetative, most of the Hykon and Kondinin plants were in full bloom, and the F2 populations had some plants in each flowering stage from vegetative to full bloom. All plants of the four F2 families reached full bloom during the 5-week period from 20 Mar. to 26 April. This presented an excellent opportunity to select late flowering in combination with high winter growth. The average size (diameter) of Overton R18 plants on 2 Feb. was about 25% less than the cultivars Kondinin and Hykon. This illustrates the poor winter growth of Overton R18 and shows the potential for improvement using selections from the F_2 families. This trend continued with the 10 Mar. measurement where Kondinin and Hykon were double the plant diameter of Overton R18. A wide range of selections with different combinations of seasonal growth and flowering were made for continued evaluation in later generations.

F_3 Evaluations, 1996. Average plant diameter for each entry, measured on 9 Feb., ranged from 4.7 to 12.0 cm for Overton R18 and F3 line R17-14, respectively. Hykon had the best winter growth of the rose clover cultivars evaluated with a diameter of 9.8 cm. Fourteen F_3 lines were identified with winter growth equal to, or better than Hykon (Table 1.).

Minimum temperatures dropped below –8 C on 3 days in Jan. 1996 and below -6.5 C on 3 days in Feb. 1996. These low temperatures caused severe damage to Hykon and Kondinin rose clover and resulted in stand losses of 69 and 46%, respectively. Cold damage to Overton R18 was moderate and stand loss was 28%. Four rose clover F_3 lines were identified with less than 10% winter damage, less than 20% stand loss and winter growth equal to Hykon (Table 1).

These experiments indicate that there is genetic potential in rose clover for improved combinations of late maturity, full season forage production and tolerance to northeast Texas winter

temperatures.

References

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Table 1 - Winter growth, cold damage and stand loss of rose clover cultivars and selected F_3 lines.

ENTRY	BLOOM DATE	PLANT DIAMETER ON 9 FEB.	WINTER DAMAGE ON 9 FEB.	STAND LOSS ON 12 APR.
		cm (STD)	%	%
R23-18	26 Apr	9.5 (2.0)	0	14
R22-18	26 Apr	11.05 (3.2)	4.3	30
R25-8	26 Apr	9.8 (3.5)	6.2	43
R5-16	20 Apr	9.5 (2.7)	5	5
R20-11	17 Apr	9.6 (3.8)	20	16
R3-21	17 Apr	9.5 (2.9)	4.7	23
R27-19	17 Apr	11.5 (3.3)	6.2	43
R17-14	17 Apr	12.0 (2.0)	7.4	14
R3-22	17 Apr	11.4 (2.5)	35.1	25
R21-16	12 Apr	9.9 (2.5)	7.7	0
R13-20	12 Apr	10.0 (4.6)	26.1	39
R7-14	12 Apr	10.2 (4.1)	66.7	40
R5-17	12 Apr	10.1 (3.3)	13.1	21
R16-24	27 Mar	9.9 (2.1)	60.1	30
Hykon	27 Mar	9.8 (4.1)	86.9	69
Kondinin	27 Mar	6.1 (2.3)	100	46
Overton R18	26 Apr	4.7 (2.0)	35	28