

SEED YIELD PERFORMANCE AND FLOWERING INITIATION OF TWELVE RED CLOVER VARIETIES (YEAR 2)

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Introduction

Forage legume seed crops, such as red clover (*Trifolium pratense* L.), continue to be a vital part of seed production enterprises and valuable rotation crops for grass seed and cereal crops grown in Oregon. Red clover, a biennial seed crop, is the most widely grown legume species in Oregon. According to OSU Extension seed crop estimates, the estimated value of red clover seed produced in Oregon in 2019 was approximately \$12.5 million, with 17,770 acres harvested (Anderson, 2020). Consistent seed sales and relatively stable prices have allowed this crop to be a profitable rotation in Oregon field cropping systems for many years.

The most commonly grown clover variety in Oregon is ‘Medium Red’. While its origins are speculated, this variety has not been recognized as a certified variety for many years. It has high yield potential, possibly due to environmental adaptation, but does not always fulfill the highest quality and performance characteristics desired by end users. Breeding efforts in the U.S. and elsewhere have resulted in the release of new genetic material, but seed yield potential for many of these varieties is unknown, and seed growers are hesitant to plant them.

The objective of this 2-year study was to measure the seed yield potential of 12 red clover varieties. ‘Medium Red’ and another historically common variety (‘Kenland’) were used as control treatments. We also evaluated percent bloom from early inflorescence emergence to harvest in order to better understand flowering length and crop maturity differences among varieties. Results from the second year of this study are presented in this report.

Results from year 1 of this study indicated that four varieties (‘Redomon’, ‘Secretariat’, ‘Dynamite’, and ‘DLFPS-102/3’) produced significantly higher seed yields compared to ‘Kenland’, while ‘Dynamite’ was the only variety that produced a significantly higher seed yield (14%) than ‘Medium Red’ (Anderson et al., 2020). All other varieties produced seed yields equal to or lower than the controls.

Materials and Methods

The field trial was established at OSU’s Hyslop Crop Science Research Laboratory in the fall of 2018. The

first- and second-year seed harvests occurred in 2019 and 2020, respectively. Plot size was 8 feet x 40 feet. The experimental design for this trial was a randomized complete block with four replications. In addition to the two controls, ten proprietary varieties were entered from seven different seed companies.

The following red clover varieties were included as treatments:

- ‘Medium Red’ (control)
- ‘Kenland’ (control)
- ‘Blaze’
- ‘Vulcano’
- ‘Freedom! MR’
- ‘Redomon’
- ‘CISCO’
- ‘Relish’
- ‘FS3662’
- ‘Secretariat’
- ‘Dynamite’
- ‘DLFPS-102/3’

Routine herbicide, molluscicide, and insecticide treatments were applied to manage pests as needed. Spring nitrogen was applied to plots at a rate of 20 lb N/acre. All plots were flailed to a height of 2–3 inches on May 7 and in the reverse direction on May 15. When regrowth reached the two-node growth stage (BBCH 32), trinexapac-ethyl plant growth regulator (Palisade EC) was applied at a rate of 2.5 pt/acre. Four inches of irrigation water was applied on June 18. Pollination was aided by honeybee hives placed nearby and by the presence of native bumblebees.

Above-ground biomass samples were taken from each plot near crop maturity, and dry weight of the standing crop was determined. Inflorescence number and number of florets/inflorescence were determined from the above-ground biomass samples.

Plots were swathed with a modified John Deere 2280 swather and combined with a Hege 180 plot combine. Subsamples of harvested seed were collected from each plot and were cleaned using a Clipper M2B

cleaner to determine cleanout percentage and clean seed yield. Seed weight was determined by counting two 1,000-seed samples with an electronic seed counter and weighing these samples on a laboratory balance. Harvest index (HI), the ratio of seed yield to above-ground biomass, was also quantified.

Results and Discussion

In this second-year trial, seed yields from ‘Medium Red’ and ‘Kenland’ were 847 and 674 lb/acre, respectively (Table 1). Two varieties, ‘Secretariat’ and ‘Dynamite’, produced higher seed yields compared to ‘Kenland’. Both of those varieties also produced seed yields that were significantly equal to ‘Medium Red’, but no varieties produced higher yields than ‘Medium Red’. All other varieties produced seed yields equal to or lower than the controls.

The two varieties with the highest seed yields, ‘Secretariat’ and ‘Dynamite’, had significantly equal seed numbers compared to the two controls (Table 1). There were mixed effects on seed weight, with some varieties producing lower seed weights compared to the controls and some having higher seed weights. Inflorescences from all varieties contained floret numbers that were equal to or less than ‘Kenland’. Three varieties, including ‘Vulcano’, ‘Redomon’, and ‘Secretariat’, produced a greater number of florets compared to ‘Medium Red’. There were no differences among varieties in cleanout, above-ground biomass, inflorescence number, or HI.

Flowering initiation varied among varieties (Table 2). There was no obvious trend that would indicate a relationship between flowering initiation and seed yield. There were some differences in percent flowering near the end of bloom; however, only one variety, ‘Secretariat’, reached full bloom earlier than all other

varieties. ‘Vulcano’ and ‘Redomon’ had a longer bloom period, but this did not appear to aid in achieving higher seed yield compared to either control.

Results of this 2-year study indicate that there are several varieties, including ‘Secretariat’ and ‘Dynamite’, that have seed yield potential equal to or better than ‘Medium Red’, in both the first and second years of production. This study provides some evidence that, while local adaptation to environment might be a factor in the historically strong yield performance shown by ‘Medium Red’, there are newer proprietary varieties that can perform just as well. These results are encouraging and suggest that the Oregon clover seed industry may have opportunities to produce varieties with improved end-use quality and performance characteristics, without giving up seed yield potential.

References

- Anderson, N.P. 2020. Extension estimates for Oregon legume seed crop acreage and production, 2019. <https://cropandsoil.oregonstate.edu/seed-crops/oregon-grass-and-legume-seed-production>
- Anderson, N.P., T.G. Chastain, C.J. Garbacik, and B.C. Donovan. 2020. Seed yield performance and flowering initiation of twelve red clover varieties (Year 1). In N.P. Anderson, A.G. Hulting, D.L. Walenta, and C.A. Mallory-Smith (eds.). 2019 *Seed Production Research Report*. Oregon State University, Ext/CrS 162.

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Table 1. Second-year seed yield, yield components, and growth characteristics of 12 red clover varieties.¹

Variety	Seed company	Seed yield (lb/a)	Cleanout (%)	Seed weight (mg/seed)	Seed number (no./m ²)	Biomass (kg/ha)	Inflorescences (no./ft ²)	Florets/ inflorescence (no.)	Harvest index (%)
Medium Red	—	847 e	2.3	1.71 f	55,702 f	10,931	91.5	109 ab	9.1
Kenland	—	674 bcd	1.7	1.66 ef	45,608 cde	9,750	65.4	115 bc	8.0
Blaze	Mountain View	604 b	1.8	1.63 e	41,387 abc	8,034	63.1	116 bc	8.4
Vulcano	Gentos	626 bc	1.8	1.62 de	43,362 bc	10,554	80.6	121 cd	6.9
Freedom! MR	Barenbrug USA	632 bc	1.7	1.94 g	36,498 a	8,122	57.4	100 a	8.9
Redomon	Van Dyke Seed	693 cd	1.9	1.58 cd	49,363 e	9,837	70.0	129 d	8.0
CISCO	Van Dyke Seed	614 b	2.0	1.56 c	44,111 bcd	9,917	74.4	120 bcd	7.2
Relish	PGG Wrightson	524 a	2.3	1.50 b	39,138 ab	7,328	77.9	109 ab	8.2
FS3662	PGG Wrightson	505 a	2.4	1.43 a	39,630 ab	8,156	83.5	112 abc	7.3
Secretariat	PGG Wrightson	790 e	1.5	1.57 cd	56,480 f	10,014	91.9	121 cd	9.6
Dynamite	Grassland	837 e	2.3	1.67 ef	56,155 f	11,203	91.5	114 bc	9.1
DLFPS-102/3	DLF Pickseed	710 d	2.0	1.64 e	48,582 de	10,367	76.5	111 abc	7.8
P-value	—	0.0000	0.1724	0.0000	0.0000	0.0837	0.0776	0.0042	0.3718

¹Numbers followed by the same letter are not significantly different at LSD.Table 2. Percent bloom from flowering initiation to full bloom in 12 red clover varieties.¹

Variety	Seed company	June 20	June 28	July 5	July 12	July 19
----- (% bloom) -----						
Medium Red	—	2.8 a	16.3 cde	50.0 c	83.8 ab	100.0
Kenland	—	2.0 a	17.5 de	50.0 c	88.8 bcd	100.0
Blaze	Mountain View	1.8 a	13.8 bc	37.5 b	88.8 bcd	100.0
Vulcano	Gentos	8.8 b	15.0 cd	36.3 b	86.3 abc	100.0
Freedom! MR	Barenbrug USA	2.0 a	16.3 cde	48.8 c	91.3 cd	100.0
Redomon	Van Dyke Seed	1.8 a	10.0 a	28.8 a	81.3 a	100.0
CISCO	Van Dyke Seed	1.8 a	11.3 ab	36.3 b	86.3 abc	100.0
Relish	PGG Wrightson	2.0 a	13.8 bc	52.5 c	90.0 cd	100.0
FS3662	PGG Wrightson	10.0 c	17.5 de	60.0 d	97.3 e	100.0
Secretariat	PGG Wrightson	10.0 c	18.8 e	48.8 c	91.3 cd	100.0
Dynamite	Grassland Oregon	1.8 a	16.3 cde	50.0 c	90.0 cd	100.0
DLFPS-102/3	DLF Pickseed	2.0 a	18.8 e	50.0 c	92.5 de	100.0
P-value	—	0.0000	0.0001	0.0000	0.0003	

¹Numbers followed by the same letter are not significantly different at LSD.