Ducks Unlimited Hay Establishment Evaluation

Project Duration: June 2023 – October 2024
Objectives: To evaluate the establishment of a hay crop with different rates of phosphorous and an oat nurse crop
Collaborators: Ducks Unlimited Canada

Background

When establishing a perennial forage crop, a common practice is to plant it with a cereal "nurse crop", such as oats or barley. The nurse crop is typically cut for greenfeed mid-summer, after which the perennial forage grows with full access to sunlight, water, and soil nutrients. Alternatively, the nurse crop may be harvested for grain, often used to feed livestock. The benefit of these practices to producers is to provide a harvestable crop in the year of establishment, even when the nurse crop is seeded at a reduced rate, as compared to normal seeding rates for greenfeed or feed grain.

Nevertheless, observations by staff at Ducks Unlimited Canada suggest that the use of a nurse crop can have a negative impact on the perennial forage crop, leading to reduced hay yields in Year 2. Although this effect may be less pronounced for oats than for barley (which can be highly competitive against other crops), observations suggest that establishing a perennial forage without a nurse crop will result in a better stand, leading to higher forage yields in Year 2 and beyond.

The current study was initiated to examine the effect of a nurse crop on perennial forage establishment, as well as to examine the effect of using starter phosphorous at a rate of 25 lb/ac (actual).

Materials and Methods

The hay seed was provided by Ducks Unlimited Canada and is an alfalfa-brome-timothy mix. The oat nurse crop was Haymaker, a tall variety with wide leaves and large seed size. This variety was used with the expectation that the "quarter rate" oat nurse crop would be cut for greenfeed. However, due to delays in cutting the treatment, all the oats were harvested for grain at maturity.

Table 1: Materials and methods.

Overview	
Design	RCBD
Entries	18 (see Table 2)
Reps	4
Harvest area	19.2 m2
2023	
Seeding date	June 15
Seeding depth	1/2-inch into adequate moisture
Preparation	Glyphosate (0.64 L/ac, May 26); tillage (June 7 and June 15)
Grain harvest date	Oct 19
2024	
Species count date	June 12
Swathing date	July 10
Hay collection date	July 17

*Table 2: Treatments**

Treatment	Rate
Nurse crop (Haymaker oat)	2 bu/ac (full rate)
	0.5 bu/ac (quarter rate)
	None
Hay mix (alfalfa-brome-timothy)	8 lb/ac
	12 lb/ac
	15 lb/ac
Phosphate (seed-placed)	No added
	25 lb/ac

** No added nitrogen; 57 lb/ac available in soil.*

Observations

Year 1

Timely rains in late June resulted in good growing conditions for all treatments. In general, hay mix-only treatments established well and competed adequately with any weeds that were present. Treatments with oats resulted in vigorous growth for oats, with varying levels of growth for the hay crops. The treatment with a full rate of oats and 8 lb/ac of hay mix showed the least growth for hay crops.

Figure 1: (left) Hay mix at 15 lb/ac without oats; (right) hay mix at 8 lb/ac with a full rate of oats.

Figure 2: (left) 12 lb/ac hay mix with full rate of oats; and (right) 8 lb/ac hay mix with quarter rate of oats

Year 2

The season began with cool weather and generally moist conditions. The hay treatments showed differences in establishment and early season growth. Plants in treatments that had a nurse crop in 2024 were visibly smaller and took longer to grow vigorously, whereas plants without a nurse crop appeared to be better established and grew more biomass earlier in the season. Later in the season, this difference in growth resulted in generally higher number of weeds in the treatments that had been grown with a cover crop. However, when the plots were swathed for hay harvest in mid-July, all treatments regrew quickly and the differences in weediness were less visible.

Figure 3: (left) weedier hay establishment (July 10); and (right) good hay establishment (July 10)

Hay yield is shown in Figure 4. The species breakdown is shown in Figure 5 and counts are in Figure 6. The hay yield was compared against the treatment of no nurse crop with 15 lb/ac of hay blend and 25 lb/ac of phosphorous ("No oat, high hay, P-25"). Yields were significantly lower for all "full oat" treatments except for "low hay, zero P" (which had a P value of 0.054). Two treatments seeded with a quarter rate of oats yielded significantly less ("low hay, zero P" and "high hay, zero P). There were no significant differences in yield for treatments that were seeded without oats.

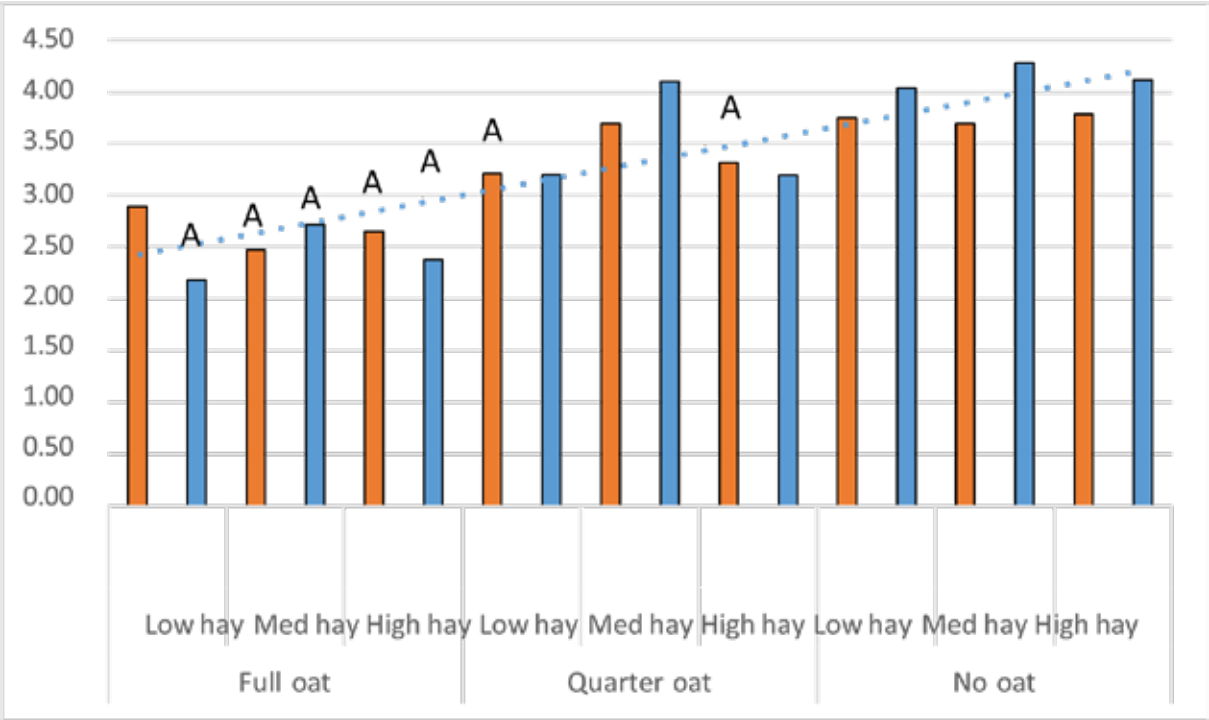

Figure 4: Hay yield by treatment (July 10, tons/acre) with statistical significance†*
** P-0 = no added P; P-25 = 25 lb/ac*
† "A" signifies that the yield for that treatment differed significantly from the yield for the "No oat, high hay, P-25" treatment.

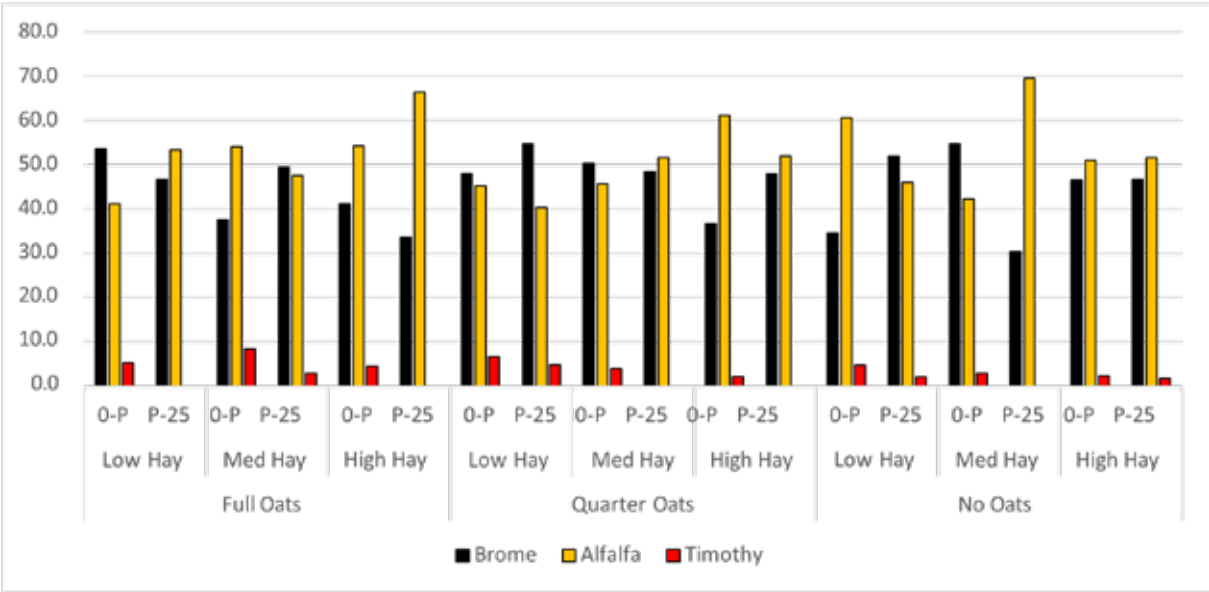

Figure 5: Species breakdown by treatment (%)

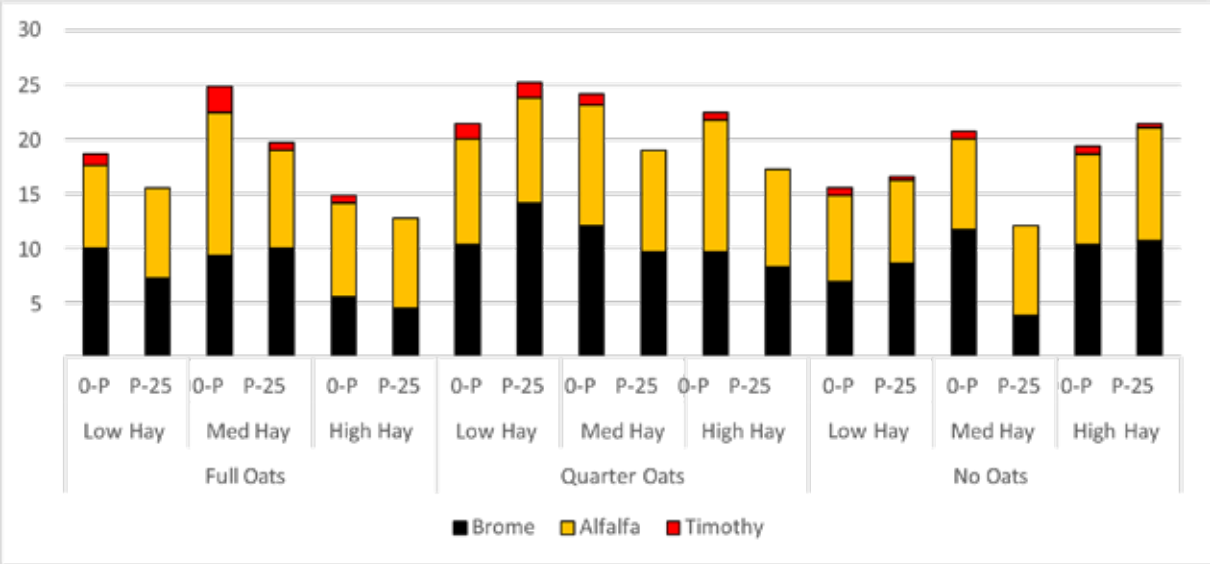

Figure 6: Plant counts by treatment (plants/m2)

Discussion

Observations from the 2023 growing season suggested that the plots established without an oat nurse crop achieved better plant growth and establishment for the hay species (brome, alfalfa, and Timothy). Plant counts occurred for each plot in early June 2024. Although the hay plants in treatments that were established with oats were noticeably smaller, the number of plants did not appear to be strongly related to whether they had been established with or without oats (Figure 6). Nevertheless, the plants in the plots that were established without oats were larger and more vigorous than plants in plots that were established with oats. Additionally, the extra vigour of these plants appeared to make them more competitive against weeds.

Hay yield in 2024 for treatments that were established without oats was significantly greater than for treatments without oats, except for the "full oat, low hay, zero P" treatment (P-value = 0.054). Nevertheless, the yields for that treatment were 30% lower than the yields for the "no oat, high hay, 25 lb P/ac" comparison. Yields for treatments including a quarter rate of oats did not differ statistically, except for the "quarter oat, high hay, zero P" and "quarter oats, low hay, zero P" treatments. Notably, average yields for the "quarter oat, medium hay, 25 lb P/ac" treatment were nearly the same as for the comparison treatment. The overall lack of differences in these treatments suggests that with good growing conditions in the year after establishment, such as were observed in 2024, hay yields may not differ significantly between crops established without oats and with a quarter rate of oats. However, the results may have shown starker differences between treatments if the growing conditions had not been as favourable. Even in a favourable year, the results show that a full rate of oats will have an adverse effect on hay yields in the year after establishment.

In general, species composition did not appear to be strongly associated with any treatment (Figure 5), but plant stand differed between treatments. Plots that received a full rate of oats in 2023 showed higher weed populations in 2024, which reduced yield. Timothy did not establish many plants across the treatments, or emerged later in the season, after the plant counts.

Agronomic information

Previous year's crop: Barley-oat silage (2022)
Soil Type: Erickson Clay Loam
Landscape: Rolling with trees to the east Fertility Information (2023)

Fertility Information (2023)

Available		Added (actual)
N	66 lb/ac	None
P	48 ppm	According to treatment
K	194 ppm	None