ANNUAL LEGUMES IN SMALL GRAIN PRODUCTION SYSTEMS

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ABSTRACT

Oats were interseeded with a number of annual legumes and monitored for forage production in 1994 and 1995. Forage was harvested when oat plants reached the soft dough stage. Subsamples were collected and analyzed for forage quality, acid detergent fiber (ADF), neutral detergent fiber (NDF), crude protein (CP), and relative feed. Fall herbage production was also monitored. Interseeding an annual legume into oat hay did not increase forage yield. When averaged over two-years, only Austrian winter peas and Maple peas produced significantly higher CP levels than the non-interseeded control. Similarly, only Austrian winter peas produced significantly higher RFV and lower ADF values than the non-interseeded control over a two-year period. Only Multicut berseem clover produced significant fall regrowth.

INTRODUCTION

Forage quality of cereal hay is generally lower than is required to meet production goals for many livestock classes. Interseeding annual legumes into small grains has increased forage quality across a number of environments. Interseeding of legumes into small grains has increased both forage and grain yield in some locations (Moynihan et al., 1994; Izaurralde et al., 1990; and Bijan and Mahapatra, 1990; Murray and Swensen, 1985). Increased yield has been attributed to nitrogen transfer from the legume (Agboola and Fayemi, 1972), weed suppression (Willey, 1979), and improved soil conditions (De Hann *et al.*, 1994; Martel and MacKenzie, 1980). The effects of legume interseeding on the subsequent year's crop is attributable to residual nitrogen transfer from decaying plant material and improved soil conditions (Mahler and Auld, 1989). It seems that indeterminate legumes with lower seed yield potentials are more beneficial to associated cereals in terms of nitrogen transfer in the current season or as residual nitrogen for subsequent crops (Ofori and Stern, 1987). It is possible to prolong the growing season past grain hay harvest date by interseeding a forage species for either hay or pasture. Interseeding a forage legume would enhance nitrogen transfer to the associated cereal and maximize residual nitrogen for the following crop.

METHODS

The trial was arranged in a randomized complete block design with four replications. Oat seed was sown to a depth of one inch with a modified Kincaid planter. Plots were fertilized with 50 lb N, 62 lb P_2O_5, and 37 lb S/acre in a band application at planting. Seed of the forage species was broadcast using the same drill and incorporated by light raking. Plots measured 5 x 20 feet with an oat row spacing of six inches. The crop was sprinkler irrigated by a solid set irrigation system.

Forage was harvested when oat plants reached the soft dough stage. Prior to harvest, plots were trimmed to 17 feet long. The crop was harvested using a flail harvester with a three-foot wide head. All yields were reported on a dry weight basis. Subsamples were collected and analyzed for forage quality, acid detergent fiber (ADF), neutral detergent fiber (NDF), crude protein (CP), and relative feed value (RFV) using a near-infrared reflectance spectrophotometer (NIRS). Fall herbage production was monitored as well. No chemical weed control was applied and weed population density was monitored. All data collected were analyzed by analysis of variance procedures.

RESULTS

Interseeding forage legumes into oats for hay at KES did not affect forage yield in 1994 or 1995 (Table 1). However, interseeding with four different legume entries (Austrian winter peas, Maple peas, Magnus field pea, and Ascot barrel medic) produced significantly higher CP levels than the non-interseeded control in 1994. In 1995, George black medic, Parabinga barrel medic, and Maple peas produced significantly higher CP levels than the non-interseeded control. Only Austrian winter peas produced significantly lower ADF and NDF values than the control in 1994. Similarly, only Austrian winter peas produced significantly higher RFV than the non-interseeded control. There was no difference in ADF, NDF, or RFV due to legume interseeding in 1995. When averaged over two-years, only Austrian winter peas and Maple peas produced significantly higher CP levels than the non-interseeded control (Table 2). Similarly, only Austrian winter peas produced significantly higher RFV and lower ADF values than the non-interseeded control over a two-year period (Table 2). Although Magnus field pea and maple pea produced significantly higher yields than Austrian winter pea when grown in monoculture in 1993 and 1992, there was no yield or quality advantage of any entry over Austrian winter pea when grown in an oat-legume mixture. Fall regrowth following cutting was visually monitored and only Multicut berseem clover produced significant regrowth. Barrel medic, burr medic, and snail medic entries had set seed and were senescing at forage harvest due to their determinate growth habit. Although they were green, black medic, sub clover, and rose clover entries did not produce significant amounts of regrowth following cutting. This may have been due to drought stress or, in the case of sub clover, it may have been due to low fall temperatures. Where fall growth following hay harvest is important, berseem clover may be the best choice. It produced forage yields and forage quality equivalent to Austrian winter pea and produced the best fall regrowth.

This trial was well irrigated and moisture stress did not limit production. The results of this trial are applicable to irrigated highly productive situations. In areas and management systems where moisture would limit plant growth, more drought resistant legumes such as the annual medics may be more productive than the pea varieties included in this trial.

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Table 1

1994 and 1995 Intercropping Oat Hay and Annual Legumes.
Forage yield, crude protein (CP), acid detergent fiber (aDF), neutral detergent fiber (NDF), and relative feed value (RFV) of oat-legume mixtures planted at Klamath Experiment Station, OR, 194 and 1995.

	1994				1995			
Variety	Yield ton/A	CP %	ADF %	NDF %	Yield ton/A	CP %	ADF %	NDF %
Ascot Barrel Medic	6.1	8.6	39.3	55.1	4.5	9.6	39.7	56.0
Borung Barrel Medic	6.1	7.8	40.2	56.8	4.4	9.3	39.8	56.7
Caliph Barrel Medic	6.5	8.1	39.8	56.1	3.8	9.6	37.5	53.6
Mogui Barrel Medic	5.6	8.4	41.0	58.4	3.8	9.0	38.1	53.7
Parrabinga Barrel Medic	6.7	7.1	42.0	60.3	4.4	10.6	52.5	
Parraggio Barrel Medic	6.2	8.3	38.9	55.7	4.0	9.7	38.4	54.2
George Black Medic	6.1	7.3	40.2	58.7	4.5	10.9	37.0	53.2
Santiago Burr Medic	5.8	7.2	42.3	59.8	3.9	9.4	38.4	54.6
Sava Snail Medic	6.4	7.7	39.0	55.9	3.8	9.8	39.7	56.8
Berseem Clover Multicut	6.4	8.3	37.7	55.1	3.9	9.1	40.7	58.3
Clare Sub Clover	6.4	6.2	41.4	59.8	3.7	9.5	38.6	54.6
Karridal Sub Clover	5.8	7.7	38.5	56.1	4.3	9.1	37.9	54.1
Monte Frio Rose Clover	6.5	6.7	39.7	57.9	4.3	10.1	38.3	54.8
Overton rose Clover	6.0	6.3	42.4	61.2	5.0	9.8	38.5	54.8
Trikkala Sub Clover	6.9	7.4	38.4	55.9	4.2	9.7	36.8	53.4
Austrian Winter Pea	6.1	9.5	37.0	53.3	4.2	10.0	38.9	54.9
Magnus Field Pea	6.1	8.7	38.4	56.0	3.8	9.9	38.6	55.4
Maple Pea	6.7	8.8	39.1	56.4	4.0	10.5	37.6	52.9
No legume (control)	6.4	6.8	41.5	59.9	4.1	10.0	40.0	56.4
Mean	6.2	7.7	39.9	57.3	4.0	10.7	37.8	54.3
CV (%)	12.1	15	7.6	7.2	4.1	9.8	38.4	54.8
LSD (0.05)	NS	1.7	4.3	5.9	NS	1.2	NS	NS

Table 2

Two-year Summary of Intercropping Oat Hay and Annual Legumes.
Forage yield, crude protein (CP), acid detergent fiber (ADF), neutral detergent (NDF), and relative feed value (RFV) of oat legume mixtures planted at Klamath Experiment Station, OR, 1994 and 1995.

Variety	Yield ton/A	Protein %	ADF %	NDF %	RFV
Ascot Barrel Medic	5.3	9.1	39.5	55.6	97.7
Borung Barrel Medic	5.2	8.6	40.0	56.7	95.2
Caliph Barrel Medic	5.1	8.9	38.7	54.9	100.4
Mogui Barrel Medic	4.7	8.7	39.6	56.0	97.2
Parrabinga Barrel Medic	5.5	8.9	39.0	56.4	97.6
Parraggio Barrel Medic	5.1	9.0	38.7	54.9	100.6
George Black Medic	5.3	9.1	38.6	55.9	98.2
Santiago Burr Medic	4.8	8.3	40.4	57.2	94.0
Sava Snail Medic	5.1	8.8	39.3	56.3	96.5
Berseem Clover Multicut	5.2	8.7	39.2	56.7	96.4
Clare Sub Clover	5.1	7.8	40.0	57.2	94.8
Karridal Sub Clover	5.1	8.4	38.2	55.1	100.1
Monte Frio Rose Clover	5.4	8.4	39.0	56.3	97.3
Overton rose Clover	5.5	8.1	40.4	58.0	92.6
Trikkala Sub Clover	5.5	8.6	37.6	54.6	101.5
Austrian Winter Pea	5.1	9.8	37.9	54.1	102.6
Magnus Field Pea	5.0	9.3	38.5	55.7	99.0
Maple Pea	5.3	9.6	38.4	54.6	101.3
No legume (control)	5.2	8.4	40.7	58.2	91.7
Mean	5.2	8.8	39.1	56.0	97.9
CV (%)	13.2	11.8	6.9	6.5	10.1
LSD (0.05)	NS	1.1	2.6	NS	9.8