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Austrian Winter Peas

A Green Manure Crop for Idaho

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The cost of anhydrous ammonia increased 312 percent from 1970 to 1980. The rising cost of nitrogen fertilizer has sparked a renewed interest in the use of green manure crops. In addition to increasing nitrogen levels, green manure crops increase organic matter content, improve physical properties and reduce soil erosion. In the state's warmer, irrigated areas, an Austrian winter pea crop can be followed by spring cereals or corn.

Field trials with Austrian winter peas were conducted from 1977 to 1980 at Moscow and Grangeville, Idaho. This publication gives the results of this work and recommended production practices for using this crop as a source of green manure.

Nitrogen Accumulation

The nitrogen in winter pea vines is taken up from residual nitrogen left in the soil profile or is fixed from the atmosphere which contains 78 percent nitrogen. Atmospheric nitrogen is fixed in nodules located on pea roots that are formed by a symbiotic bacteria called *Rhizobium*. As the level of nitrogen in a soil increases, the proportion of the nitrogen in pea vines taken from the air decreases. The addition of 60 pounds of nitrogen per acre to a soil containing almost no residual nitrogen reduces nitrogen fixation of winter peas by 37 percent. Because most agricultural soils have relatively high levels of residual soil nitrogen, a large proportion of the nitrogen in pea vines is taken up from the soil.

The nitrogen stored in pea vines is not leached from the soil during winter rains or irrigation until the vines are decomposed. Winter peas not only fix nitrogen from the atmosphere but provide a means of stabilizing the soil nitrogen left after cereal crop production. Much of this residual soil nitrogen would be leached beyond the rooting zone of most crop plants if not taken up by a green manure crop.

Planting Date

Early planting of 'Fenn' resulted in higher organic matter yields at both Moscow and Grangeville (Table 1). At Moscow, where the peas were grown under near optimum conditions, 4.3 tons of organic matter per acre were obtained. Delaying planting by 1 month reduced organic matter yields by 1.8 tons per acre. The peas grown at Grangeville suffered severe damage from Fusarium root rot, and even the peas seeded in mid-September at this location yielded only 1.9 tons of organic matter per acre.

Later planting and the Fusarium root rot at Grangeville reduced the total nitrogen accumulated in the pea vines (Table 1). At Moscow, an average of 237 pounds of nitrogen per acre would have been returned to the soil with early seeding. At Grangeville, the late-seeded peas would have returned only 43 pounds of nitrogen per acre.

Fig. 1. Plowing down the vines of Austrian winter peas improves the organic matter content and physical characteristics of a soil.

Harvest Date

Organic matter yield increased as peas were harvested at later dates (Table 2). The greatest organic matter yield was obtained on those peas harvested July 6 with yields of 5.3 tons per acre. However, the total vine nitrogen increased only 25 pounds per acre as harvest was delayed from June 6 to July 6. Most of the nitrogen in the pea crop was already stored in the crop canopy shortly after flowering began.

Peas grown as a green manure crop can be turned down immediately after flowering without greatly reducing the amount of nitrogen returned to the soil. Pea vines at this stage are more succulent and decompose quicker than more mature pea vines. In many of Idaho's warmer, irrigated production areas, a green manure crop of Austrian winter peas plowed down shortly after flowering can be followed by crops such as corn or barley.

Table 1. Organic matter yield and vine nitrogen from 'Fenn' Austrian winter peas planted on two different dates at Moscow and Grangeville, Idaho, in 1977.

Date of planting	Organic matter yield	Vine nitrogen
	(tons/acre)	(lb/acre)
Moscow		
Sept. 2, 1977	4.3	237
Oct. 4, 1977	2.5	145
Grangeville		
Sept. 14, 1977	1.9	78
Oct. 5, 1977	1.1	43

Table 2. Organic matter yield and vine nitrogen of 'Fenn' Austrian winter peas harvested at three dates at Moscow, Idaho, in 1978.

Date of harvest	Organic matter yield	Vine nitrogen
	(tons/acre)	(lb/acre)
June 6	3.1	175
June 19	3.7	181
July 6	5.3	200

Table 3. Organic matter yield and total vine nitrogen of five varieties of Austrian winter peas at Moscow, Idaho, in 1979 and 1980.

	Organic matter yield			Total vine nitrogen		
Variety	1979	1980	Average	1979	1980	Average
	(tons/acre)			(lb/acre)		
Melrose	5.1	7.2	6.2	234	322	278
Fenn	4.5	5.3	4.9	231	250	240
Common	4.2	5.2	4.7	207	244	225
ID 89-1	4.0	3.3	3.7	273	199	236
Romack	3.7	5.5	4.6	192	258	225
Average	4.3	5.3	4.8	227	254	

Austrian Winter Pea Varieties

'Melrose' produced the highest yields in both 1979 and 1980, averaging 6.2 tons of organic matter per acre (Table 3). Fenn and 'Common' produced an average of 4.9 and 4.7 tons of organic matter per acre, respectively. Neither the semidwarf line 'ID 89-1' nor the Georgia variety, 'Romack,' produced consistently high yields of organic matter. Melrose accumulated an average of 278 pounds of vine nitrogen per acre. The other varieties accumulated from 225 to 240 pounds of nitrogen per acre. Melrose produced the highest organic matter yield and accumulated the most nitrogen per acre of the five varieties tested.

Spring vs. Winter Pea Varieties

The winter-planted peas were harvested June 19, the early maturing spring peas July 2, the late maturing spring peas July 10 and the spring-planted Austrian winter peas July 19 (Table 4). The four long-vined winter planted Austrian winter pea varieties (Fenn, Melrose, Common and Romack) produced 5.8 tons of organic matter per acre compared to 5.4 tons for the six spring pea varieties. The four long-vined Austrian winter pea varieties produced only 3.1 tons of organic matter when spring planted. The semidwarf line ID 89-1 produced only 2.7 tons of organic matter when fall planted in this study and only 2.4 tons as a spring-planted crop, indicating lines of this type would not make good green manure crops.

Table 4. Organic matter yield and vine nitrogen of five varieties of fall and spring planted Austrian winter peas and six varieties of spring peas.

Date of seeding/variety	Harvest date	Organic matter yield	Total vine nitrogen
		(tons/acre)	(lb/acre)
Seeded Sept. 5, 1979			
Winter peas:			
Common	June 19	6.2	278
Romack	June 19	6.2	318
Melrose	June 19	6.1	282
Fenn	June 19	4.6	201
ID 89-1	June 19	2.7	174
Average		5.2	250
Seeded April 16, 1980			
Spring peas:			
'Latah'	July 2	6.8	382
'Tracer'	July 2	5.8	307
'Alaska'	July 2	5.4	281
'Garfield'	July 10	5.0	286
'W 710431'	July 10	4.7	346
'DSP'	July 10	4.6	313
Average		5.4	320
Winter peas:			
Melrose	July 18	3.5	177
Fenn	July 18	3.0	180
Romack	July 18	3.0	178
Common	July 18	2.9	164
ID 89-1	July 18	2.4	191
Average		3.0	178

Fall-planted Austrian winter pea varieties and spring pea varieties produce nearly equivalent yields of organic matter. However, the fall-planted Austrian winter pea can be plowed down nearly 2 weeks earlier than the spring peas, allowing the conservation of valuable soil moisture in dryland production areas and the possibility of recropping in irrigated regions.

The spring pea varieties accumulated 70 pounds per acre more vine nitrogen than winter-planted Austrian winter pea varieties (Table 4). The spring-planted Austrian winter peas accumulated only 188 pounds of nitrogen per acre. The variety 'Latah' accumulated 382 pounds of nitrogen while producing 6.8 tons of organic matter per acre. Even allowing for some yield inflation inherent in experimental plots, the amount of forage production and the vine nitrogen produced by both fall-planted Austrian winter peas and spring peas indicates that peas could be an important source of organic matter and green manure nitrogen.

Table 5. Comparison of the costs for wheat-barley-summer fallow rotation and wheat-barley-Austrian winter pea-green manure rotation during 1981.

	Variable costs per acre	
Operation	Wheat-barley fallow	Wheat-barley green manure
Summer fallow or Austrian winter pea plow down	($)	(1)
Fall operations		
Disk	3.26	3.26
Chisel	3.37	3.37
Cultivate/harrow	—	1.55
Plant	—	1.81
Seed cost	—	9.00
Spring operations		
Insecticide	—	6.26
Application	—	4.50
Cultivate/harrow	1.55	—
Summer operations		
Moldboard plow	—	5.50
Disk	—	3.26
Cultivate/harrow	—	1.55
Rod weed	1.37	—
Rod weed	1.37	—
Rod weed	1.37	1.37
Winter wheat crop		
Fall		
Shank in fertilizer	21.60*	14.40**
application	.80	.80
Spring		
Fertilizer application	22.20*	—
Aerial application	4.50	—
Interest on capital	1.44	2.27
Total cost	62.83	58.90

*Assumes applications of 60 pounds of nitrogen per acre.

**Assumes application of 40 pounds of nitrogen per acre.

Source: The principal source of data from which this table was constructed was University of Idaho Misc. Series No. 62, *North Idaho Crop Enterprise Budgets*, Aug. 1980 by T. A. Powell, K. H. Lindeborg and C. S. McIntosh.

Economic Evaluation

The cost of 1 year of summer fallow was compared with the cost of planting Austrian winter peas as a plow down manure crop in a dryland rotation. This budget assumed:

1. The two crop rotations evaluated are a wheat-barley-summer fallow rotation and a wheat-barley-winter pea-green manure crop rotation.
2. Summer fallow is included in the rotation to (a) control weeds, (b) reduce cereal diseases or (c) comply with a set-aside program which restricts crop acreage. In areas where summer fallow is used to store soil moisture, green manuring Austrian winter peas would have only limited value.
3. The wheat crop would be fertilized. Plowing down Austrian winter peas will reduce the amount of nitrogen applied by 80 pounds per acre. It is assumed the yield of the winter wheat crop will be the same in both rotations.
4. The peas will be plowed down in early June to prevent weeds from setting seeds and to prevent the excessive loss of soil moisture which does not occur when peas are harvested as a seed crop.
5. Only variable costs are considered in these tables. The fixed costs are assumed to be the same for both summer fallow and a green manure crop since the farmer already owns the equipment used in both crop rotations.

The fallow operation and applying 120 pounds of nitrogen would cost $62.83 while producing an Austrian winter pea plow down crop and applying 40 pounds of nitrogen would cost $58.90 (Table 5). This analysis indicates that there is currently no significant economic advantage to producing a green manure crop under dryland conditions even when summer fallow is included in the crop rotation for reasons other than soil fertility. The budget would need to be adjusted, however, if more or less nitrogen were added by the green manure crop or if the price of nitrogen fertilizers changes substantially. If the cost of nitrogen continues to increase, the use of green manure plow down crop should become more profitable. However, the intangible benefits of a green manure crop in controlling soil erosion, improving plant nutrient uptake and soil tilth could be obtained by growers contemplating a year of summer fallow without any increased production costs.

Summary

Austrian winter peas are an excellent green manure crop for many Idaho production areas. The variety Melrose produced the most organic matter per acre and accumulated more nitrogen than the other winter pea varieties. This variety should be seeded at 60 pounds per acre in early September on

Fig. 2. Austrian winter peas form a thick canopy with individual vines up to 10 feet in length.

barley stubble that has been chiseled and disked. The production of a winter pea green manure crop requires less moisture than a spring pea green manure crop and allows an earlier plow down.

In those areas with a history of pea leaf weevils, pea fields may need to be sprayed in the early spring if insect feeding threatens to reduce the stand. Because most winter annuals and grassy weeds will not produce seed if the crop is plowed down in early June, weed control is necessary only in those fields with weed populations that would reduce pea stands through competition. See Idaho Agricultural Experiment Station Bulletin No. 578, *Dry Pea and Lentil Production in the Pacific Northwest,* for insecticide and herbicide recommendations for Austrian winter peas.

The peas should be plowed down after full bloom when each vine has one or more reproductive nodes and before soil moisture becomes limited in dryland production areas. Volunteer peas could be a problem if plow down is delayed until matured seed has formed.

The nitrogen contained in the pea vines represents soluble nitrogen taken up from the soil profile as well as atmospheric nitrogen fixed by the peas' *Rhizobium* nodules. The proportion of nitrogen fixed and accumulated will depend on the level of residual nitrogen in a particular field. In either case, the nitrogen is stored in the organic matter and will be released over a period of 2 to 3 years as the vines decay. In soils with extremely low levels of organic matter, green manure crops should improve the soil's tilth, moisture holding capacity and ability to hold other plant nutrients such as phosphorus and potassium in forms available for plant uptake.

To be effective, a green manure crop should be included in a crop rotation every 3 to 5 years. The use of Austrian winter peas as a green manure crop will be most effective if it is used as a replacement for conventional summer fallow. Economic analysis indicates that producing Austrian winter peas as a green manure crop would compete favorably with conventional summer fallow in many dryland crop rotations.

Most research indicates that a rotation including a green manure crop prevents the additional loss of organic matter from the soil rather than restoring it to the level present before the soil was cultivated. Individual growers will need to experiment with Austrian winter peas to determine where and if this green manure crop fits into their rotation.

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