

TURNIPS AS A ROTATION CROP

by

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INTRODUCTION

Many of you may wonder why turnips? Turnips are one of the root crops grown in Europe for centuries for livestock feed. In Europe they produce large quantities of winter feed.

On a Columbia Basin Wool Grower tour to Southern Idaho we found them using turnips as a second crop for feed production. If they can successfully grow turnips for feed at American Falls, Idaho, we should be able to do better here since we have a longer growing season.

Are we really making full use of our production resources of growing season, land, water, irrigation system and investment? Based on 1974 plantings, 35% of the land in the Columbia Basin Project was open during July and early August. If we look at the newer irrigated areas of Central and Southern Washington, 35% could mean as much as 200,000 acres.

While a major portion of this 200,000 acres is committed to other crops in a crop rotation system, there are lots of acres not being fully used.

Turnips - Feed Value and Yield

Now let's take a look at turnips as a second crop following early potatoes, peas, cereal grains or other crops that are harvested in July or early August.

In the summer of 1975, Purple Top turnips were compared with 20 other crops. The results are shown in the Nutrient Analysis Summary Table 1. These results compare the crops based on a common planting and harvesting date. Some crops are at a real advantage since they do not mature as fall approaches. Please keep in mind we are looking at these crops as potential fall pasture.

Please Note:

The information presented here and in the talk is the result of observations, field trials and unpublished research involving several people. Major Washington State University contributors include Mr. Irving Dow, Extension Soil Specialist; Dr. David Evans, Associate Agronomist; Dr. Wilton Heinemann, Animal Scientist; Dr. Ken Morrison, Extension Agronomist and the Grant-Adams Area Extension staff who are John W. Burns, David L. Gossett, Elvin L. Kulp, John L. Moore, Ladd A. Mitchell, Timothy J. Smith and Kenneth E. Waud. In addition, several farmers and stockmen along with nearly all Central Washington seed and fertilizer dealers have helped make this information possible.

TABLE I

SECOND CROPPING FOR FALL, WINTER, OR SPRING PASTURE

Nutrient Analysis Summary
 Dry Matter Basis
 George Washington Area L 5

Planted -- 7-1-75 Harvested -- 10-2-75

	Total Protein %	Rumen Digesti- bility %	P %	K %	Ca %	Mg %	Zn ppm	Total N %
Alfalfa (pre-bud)								
19% dry mat.	26.6	73.2	.36	3.52	1.27	.25	25.8	4.25
Choumoilier	12.1	83.0	.38	3.63	2.11	.42	26.7	1.93
Clover, Ladino	20.4	68.6	.37	3.66	1.33	.47	35.0	3.27
Clover, N Z White	26.9	69.7	.42	4.07	1.29	.36	28.9	4.30
Collards	13.0	79.4	.30	2.94	1.99	.43	34.0	2.08
Corn 74764 Silage	7.5	32.9	.18	1.77	.31	.28	31.7	1.20
Corn 74204 Sweet	7.3	60.4	.18	1.43	.25	.21	21.8	1.17
Corn 74205 Sweet	8.5	62.2	.22	1.64	.21	.19	34.1	1.36
Corn (Field) Drill sow	8.2	40.7	.18	1.56	.28	.23	45.8	1.32
Millet, Manta Foxtail	10.6	32.6	.22	2.15	.37	.39	31.6	1.69
Millet, Pearlex 24	7.9	50.0	.18	2.11	.33	.31	16.3	1.27
Essex Rape	17.2	85.8	.42	4.26	1.86	.41	36.6	2.75
Rutabagas, roots	12.1	83.2	.45	3.20	.39	.16	23.2	1.93
Rutabagas, tops	15.3	66.2	.32	3.79	2.30	.51	24.0	2.45
Ryegrass, annual	11.2	46.3	.34	4.18	.60	.38	27.0	1.79
Sudan, sorghum	9.6	36.2	.19	1.40	.33	.30	24.6	1.53
Turnips, 7 top	17.4	87.1	.43	4.89	2.01	.45	32.4	2.79
Turnips PT top	15.8	68.5	.29	3.45	3.47	.19	30.0	2.53
Turnips PT root	11.9	82.6	.44	3.55	.78	.66	41.2	1.91
Vetch, Hairy	21.6	39.4	.40	3.32	.93	.39	61.7	3.46
Wheat, hyslop 22% dry matter	15.0	51.4	.49	3.65	.32	.21	32.0	2.40

The comparison figures in Table II are the yields of dry feed and nutrients of the top cool season and warm season crops. All crops were planted on 7-1-75 and harvested on 10-2-75. You will note the lower digestibility values for most of the warm season crops. This is due to limited kernel set and hardening off as fall approaches.

TABLE II

YIELDS AND NUTRIENT CONTENT OF CROPS GROWN AS SECOND CROP
Planted 7-1-75 Harvested 10-2-75
Grown in 140 day Frost Free rated area

<u>Cool Season Crops</u>	<u>Green Wt.*</u>		<u>Dry Feed*</u>		<u>Total Protein*</u>		<u>Rumen Digestible Material</u>	
	<u>Ton/A.</u>	<u>%</u>	<u>Ton/A</u>	<u>%</u>	<u>Ton/A.</u>	<u>%</u>	<u>Ton/A</u>	
Purple Top Turnip top	12.5	10.2	1.3	15.8	.20	68.5	.9	
Purple Top Turnip root	42.1	7.7	3.2	11.9	.39	82.6	2.7	
Purple Top whole plant	54.7 h	8.3	4.5 efg	13.0	.59 g	78.4	3.6 h	
Essex Rape	29.8 g	12.3	3.7 cde	17.2	.63 h	85.6	3.1 gh	
Georgia Collards	20.1 def	14.3	2.9 bc	13.0	.38 def	79.4	2.3 def	
Low Stem Kale (Choumollier) (1/4 stand)	13.3 abc	12.6	1.7 a	12.1	.20 ab	83.0	1.4 bc	
<u>Warm Season Crops</u>								
Pearlex 24 Millet	24.2 fg	21.9	5.3 fg	7.9	.42 ef	50.0	2.6 fg	
Sweet Corn 74205	24.3 efg	17.3	4.2 def	8.5	.36cdef	62.2	2.6 fg	
Drill Sow Field Corn	30.5 g	17.9	5.5 g	8.2	.45 ef	40.7	2.2 ef	
Sudax Sorghum Sudan	17.9 cde	23.7	4.2 def	9.2	.41 ef	36.2	1.5 cd	
90-day silage corn 7476	24.3 efg	17.0	4.1 de	7.5	.31bcde	32.9	1.3 bc	

*Numbers sharing the same letter are not significantly different at the 5% level using Duncan's New Multiple Range Test.

CROPPING GUIDE

	<u>TURNIP</u>	<u>ESSEX RAPE</u>
Planting Date	April 1 to August 1	March 1 to September 1
Harvesting Date	Graze 75-90 days after planting (can be grazed only once)	Graze 60-75 days after planting plus summer regrowth (will re-grow several times.)
Life	Vegetative first year Sets seed second year	Vegetative first year Sets seed second year
Varieties	Purple Top White Globe Cow Horn York Globe ⁴ (has shown high yields in Willamette Valley)	Essex - only one used to date.
Seeding Rate Per Acre Seed bed	2-3 pounds/acre Firm	4-5 pounds/acre Firm
Space and seeding methods	Broadcast or 12" rows Broadcast (with airplane, mixed with fertilizer or with grain drill.)	Use grain drill or broadcast seedlings.
Planting Depth	Surface to ½" deep	Surface to ½" deep
Columbia Basin Yields	Range 1.5 to 4.5 ton dry matter Green tops 10% dry matter Mature tops 15% dry matter Root 10% dry matter	Range 1.5 to 3.7 tons dry matter Contains 12% dry matter
Water Requirement	Maintain high soil moisture level by keeping available soil moisture at the 70-80% of capacity level.	
Weed Control	Work is underway to clear several pre-emerge chemicals but the labels are not cleared yet. Until they are, must depend on cultural practices and competition.	High competitor Normally none needed
Insect Problems	- spring seeded - Cabbage maggot, cabbage loopers, fall army worm, zebra caterpillar and aphids may be a problem in turnips. - Cabbage loopers and aphids may be a problem in Essex Rape. - summer seeded - Less problem is expected except aphids in Essex Rape.	
Fertilizer (Present best estimate)	Apply phosphate, potassium, boron and zinc according to soil test. Nitrogen on new ground 100#/A. Nitrogen on cropped land 80#/A. If following good fertilizer program, only nitrogen needed.	

NOTE: - Give consideration to residual fertilizer from previous crop. Following peas 40-70 pounds nitrogen per acre may be adequate. Following grains 100 pounds per acre nitrogen will be needed plus 40 pounds of nitrogen for each ton of straw incorporated into the soil. (Straw yield = 2 times the grain yield. Roughly 60% of nitrogen used in straw breakdown will be available the following year.)

CROPPING PROCEDURES FOR TURNIPS OR ESSEX RAPE

- Plan 1. Planted after peas, early potatoes or burned grain fields.
- a. Seed bed preparation - very little if any will be needed. Smooth the ground only if needed for later cropping.
 - b. Weed control - if weeds were controlled in the previous crop then generally none will be needed. Weeds need to be controlled in any case. Chemical weed control help will be available as soon as registrations are complete.
 - c. Seeding - Broadcast or drill very shallow - 1/4 to 1/2 inch at very most. Always pack following seeding. Successful seeding practices for alfalfa will work here.
 - d. Fertilizing - Apply at least half of the fertilizer needed at or just following seeding. Time is short so a quick start is important.
 - e. Watering - Use practices similar to new seeding alfalfa to reduce crusting problems. Turnips and rape are faster growing, however. Generally, keep the root zone wet for the first two to three weeks then follow the evaporation schedule.
 - f. Wind erosion considerations - if turnips planted alone there is very little left after complete grazing. The soil will not be protected. To solve this problem several things can be done; 1) Plant in strips along with the turnips such crops as rape, collards, choumollier, 1,000 headed kale, sweet corn, sudan or forage millet. The last three are warm season crops so will not work if planted after July 15. Also, they will not work if a chemical weed control program is used. 2) Spread straw as roughage and ground cover as the turnips are used.
 - g. Grazing - Greatest carrying capacity will result from strip or block grazing so that a small portion can be cleaned up before moving to fresh feed. Turnips to be grazed in the spring should not be disturbed in any way through the winter months. If killed the turnip will rot and be lost as feed.
 - h. Possible problem considerations - Turnips - there is some danger of winter kill thus loss as spring feed.
Essex rape - The literature indicates that both cattle and sheep can bloat on straight rape so feed it with another non-bloating crop.

BUDGET PLAN 1 - ESTIMATED COST OF GROWING TURNIPS

FOLLOWING DRY PEAS

	<u>Per Acre</u>	<u>Your Estimate</u>
Plant Turnips and Fertilize		
Custom Application - aerial or ground	\$ 4.50	
Seed - 2-1/2 lbs. @ \$1.00	2.50	
Nitrogen fertilizer ^a - 60 lbs. @ \$.25	15.00	
Strip Plant Choumollier		
Seed - .125 lbs. @ \$3.00	.38	
Labor, fuel, repairs ^b	1.00	
Irrigation ^c - 15 inches, 45 revolutions		
Labor ^d - 1.00 hour/rev. @ \$3.50/hour	1.20	
Power - @ 1.055¢/KWH	3.96	
Cash Overhead		
Travel - 10 miles per acre @ \$.12	1.20	
Interest on Operating Capital - 3 mo. @ 10%	.74	
Total Variable Costs Per Acre	\$30.48	

^a Turnips following burned grain will require about 80 pounds of N per acre

^b Assume 6.0 ac/hr @ \$6.00/hour

^c Center pivot sprinkler system

^d Operation and maintenance

Plan 2. Planted after wheat or barley.

- a. Seed bed preparation - Very little if any will be needed unless you decide to plow the straw down. Then a firm seed bed should be prepared.
- b. Weed control - The volunteer grain will be the worst weed. Until labels for this use are cleared on available chemicals one will need to; 1) depend on weed control from the previous crop; 2) reducing grain shatter; 3) practices which will favor the turnip and rape crop over the weeds.
- c. Seeding - 1) Aerial broadcast ahead of grain harvest will place the seed on the ground under straw. After maximum straw removal standing straw will need to be mashed down. A packer will do this plus place the seed in firm contact with the ground. 2) Open a shallow flat furrow 10 to 12 inches wide with tool bar mounted sweeps. Drill not over 1/2 inch deep or broadcast into this furrow. The seed and initial fertilizer should be placed in this furrow as sidedress. 3) Broadcast seed into standing stubble then pack both down with packer. If straw is left windrowed behind combine then seeding and fertilizing the ground between windrows would favor the crop unless heavy grain shattering has occurred.
- d. Fertilizer - Both broadcasting and nitrogation through the irrigation system have worked well. In this case one must consider the amount of nitrogen tied up in the straw breakdown process. If straw is worked in then 40 pounds per ton of straw is needed above crop requirements. If straw is left on top of ground then 40 or 50 pounds additional nitrogen will be required.
- e. Watering - same as 1-e above.
- f. Wind erosion consideration - By keeping the straw on the surface wind erosion will be minimized.
- g. Grazing - same as 1-g above.
- h. Possible problem consideration - same as 1-h above.

**BUDGET PLAN 2 - ESTIMATED COST OF GROWING TURNIPS FOLLOWING
GRAIN - ROW PLANTED WITH BANDED FERTILIZER**

	<u>Per Acre</u>	<u>Your Estimate</u>
Plant and Fertilize (one operation) ^a		
Labor, fuel, repairs	\$ 1.00	
Seed - 2-1/2 lbs. @ 1.00	2.50	
Nitrogen Fertilizer - 40 lbs. @ .25	10.00	
 Irrigation ^b - 15 inches, 45 revolutions		
Labor ^c - 1.0 hour/rev. @ \$3.50/hour	1.20	
Power - @ 1.055¢/KWH	3.96	
Nitrogen Fertilizer - 80 lbs. @ .25	20.00	
 Cash Overhead		
Travel - 10 miles per acre @ \$.12	1.20	
Interest on Operating Capital 3 mo. @ 10%	1.20	
 Total Variable Costs per Acre ^d	\$41.06	

^a Assumes 60 HP tractor pulling a 14-foot tool bar. A shallow furrow is made with 12" sweeps (duck feet) on 24" centers. Seed and fertilizer are band in furrow.

^b Center-pivot sprinkler system

^c Operation and maintenance

^d Normally some straw will be baled and removed from the field. Returns from the sale of straw will usually offset cost of removing straw. Any net returns should be applied to the grain crop rather than the pasture enterprise.

Livestock Nutritional Needs

Each class of livestock has different basic needs. (See Table III). Matching these requirements and the period of need with composition and growth patterns of the crop to be grown is very important. Thought needs to be given to class of livestock as well as crop situation when selecting a feed crop to plant.

TABLE III

MINIMUM FEED REQUIREMENTS ON DRY MATTER BASIS

<u>Animal Considered</u>	<u>Wt.</u> <u>Lbs.</u>	<u>Gain</u> <u>Lbs./Day</u>	<u>Dry Feed</u> <u>Lbs.</u>	<u>Total Protein</u>		<u>Total Digestible Material</u>	
				<u>%</u>	<u>Lbs.</u>	<u>%</u>	<u>Lbs.</u>
Winter stock cow	1000	none	15	5.9	.88	50	7.5
Stock cow	1000	milking	21.8	9.2	2.00	57	12.43
Growing steer calf	440	1.1	10.8	11.1	1.20	63	6.8
Growing steers	660	1.1	17	10.0	1.70	57	9.7
Growing steers	880	1.1	21.4	8.9	1.90	57	12.2
Finish yr. steer	660	2.87	18.3	11.1	2.02	72	13.2
Finish yr. steer	880	2.87	22.7	11.1	2.52	72	16.3
Winter mature ewe	154	.02	2.6	8.9	.23	55	1.4
Mature ewe	154	milking	6.2	11.5	.71	65	4.0
Finishing lambs	77	.48	3.1	11	.34	67	2.0
Finishing lambs	99	.55	3.7	11	.40	70	2.6

Grazing Yields

Columbia Basin stockmen have used turnips as fall feed for several years. They are an excellent breeding stock feed. Most have used them in combination with other feeds.

Grazing Yields
Purple Top Turnips

<u>Location</u>	<u>Date Seeded</u>	<u>Green Wt Tons</u>	<u>Days Grazing</u>	<u>Gain Per Day</u>
<u>Feeder Lambs In At 90 Pounds</u>				
George	July 1	50T	2700	.33 lbs.
Prosser	August 1	33T	2200	.26 lbs.
<u>Mixed Age Cattle</u>				
Othello	August 10	35T	9 AUM	
<u>Feeder Steers In At 900 Pounds</u>				
Prosser	August 1	33T	300 AU	

Note: AU = Animal Unit = one 1000 pound animal
AUM = One animal Unit for one month