

Oregon Agricultural College  
Experiment Station

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Common Vetch

By

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and

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CORVALLIS, OREGON

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## SUMMARY

1. Vetch is the most important annual legume grown in Oregon. There is annually produced from 15,000 to 45,000 acres.

2. Vetch is used for hay, seed, soiling, pasture, silage, green manure, cover crops, and honey production.

3. Imported Common vetch seed consisting of many varieties is not so good as the more uniform home-grown seed.

4. Vetch is suited to a moist, cool climate free from extremes of heat or cold during the growing season. Western Oregon is the leading producer. Spring planting unless very early is not successful.

5. Medium to heavy, well drained soils are best. Soils very poor in fertility are not productive. Excessively rich soils cause too rank growth and lodging. Common vetch will not stand quite as wet or sour conditions as Hungarian vetch.

6. Inoculation is not commonly necessary for vetch in Western Oregon except on the more acid coast soils.

7. Early planting in the fall (late September to mid October) is best. It may well be earlier for cover and green manure crops. Only very early planting in the spring will make a good growth.

8. Depending in part on seed prices, 60 to 80 pounds alone, or 60 to 80 pounds with 40 pounds of Gray winter oats are the best acre rates of sowing. The 80-pound rate is best when the seed is cheap.

9. Mixtures of grain and vetch are usually preferred for hay and sometimes for seed. Rye-and-vetch is a soiling, cover, and green manure mixture and the seed can be separated fairly well. Oats and vetch are used generally and separation of seed is fairly easy. Barley and vetch, and wheat and vetch, used respectively for silage and hay, are inseparable under ordinary circumstances and should not be sown together for seed.

10. Vetch for hay is ready to cut when the lower pods are about two-thirds filled or when the cereal planted with it is in a soft dough. For silage vetch is cut when the lower pods are two-thirds filled to filled but before the seeds get hard.

11. Seed harvest must be timely to prevent shattering. Handling carefully and careful threshing are essential to prevent loss of valuable seed by shattering and cracking.

12. Good vetch straw is valuable for feed and fertilizer.

13. Vetch seed is sometimes used for feed. It is rich enough in food value but so poor in palatability as to be of small consequence for stock feed.

14. Vetch may be used for early pasture and for hay or seed, later. The vetch recovers best in cool moist years.

15. Vetch is highly productive as a silage crop. It is one of the best considering food value and cost of production. The silage is available in summer when pasture is short.

16. Vetch is a good green feed crop for spring and early summer use.

17. Vetch is one of the best green manure and cover crops.

18. Vetch should be grown in a rotation, preferably with a cultivated crop like corn or potatoes and a cereal. Vetch grown continuously results in more weeds and there is a disease hazard.

19. Light land-plaster applications have helped vetch yields slightly in the experiments and paid for a short time. On some soils large increases are secured. Lime applications did not pay on this trial although on some very acid soils good results are secured.

20. There are few pests and diseases that are serious with vetch. Rotation and clean farming, to prevent harboring places for insects, animals and diseases, are the best control measures.

21. There are several promising strains of Common vetch for special uses.

# Common Vetch

By

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and

G. R. HYSLOP

Common vetch is the most important annual leguminous forage crop grown in Oregon. Botanically it is known as *Vicia sativa*. It is a spring vetch. In Oregon it is commonly called gray, black, or English vetch; sometimes it is called tares.

In this bulletin it will henceforth be referred to simply as "vetch."

It is principally grown in Western Oregon, Western Washington, and California. In these localities of mild winter temperatures it is usually seeded in the fall. It may also be fall seeded in the southeastern states. In these same sections small acreages are often seeded in the spring, but results are usually not as good as when fall seeded.

Because of the importance of this vetch as a general farm crop, the Oregon Experiment Station, in cooperation with the Office of Forage Crop Investigations, Bureau of Plant Industry, United States Department of Agriculture, has done extensive investigational work with it.

The acreage of this vetch in Oregon varies from 15,000 to 45,000 a year. Of this 65 to 75 percent is in the Willamette Valley. There is probably a larger annual percentage of fluctuation in acreage of vetch than for other crops. This is because it is often used as a substitute crop in common rotation systems and because of fluctuations in market prices to which it is subject. Following years of serious insect damage there is usually a reduced acreage. A small acreage of other legumes, especially clover, means a larger planting of vetch, and vice versa. A previous year's surplus of other legume hay usually reduces the current year's vetch acreage. A good fall for seeding results in a larger acreage, while a short season of fall planting reduces it.

Vetch is important in Western Oregon agriculture. It is comparatively easy to grow, is an excellent producer, and can readily be included in Western Oregon cropping systems.

**Vetch has many uses.** Vetch is generally grown as a hay or seed crop, and is also used for soiling, pasture, silage, green manure, cover crop, and honey production purposes. It is a practical annual farm legume.

The value of vetch in this state as a hay crop amounts to from \$400,000 to \$500,000 a year, and its value as a seed crop is shown by the census to be in round numbers, \$125,000 to \$153,000 a year. The large number of other uses to which it is put will approximate a value of \$50,000 to \$75,000 a year. For hay it equals in production per acre either

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Note: Forage crop work at the Oregon Experiment Station is conducted in cooperation with the Office of Forage Crop Investigations, Bureau of Plant Industry, United Department of Agriculture, and credit for the results obtained is hereby acknowledged as jointly due to the above named office and the Oregon Experiment Station.

The experimental work reported in this publication was begun in 1914 under the supervision of Professor H. D. Scudder of the Oregon Experiment Station, and carried out during that year by H. M. Carnes. Since that time the work has been continued by H. A. Scooth.

alsike or red clover, and when properly cured is equal to either in palatability and nutritive value.

In the cropping system vetch compares very favorably with other annual and biennial legumes as a soil enricher.

Our vetch seed often comes in direct competition with seed imported from Europe as spring vetch. The annual imports have ranged from 29,900 pounds to 2,075,644 pounds, with an average of 718,300 pounds for the thirteen years beginning with 1911. In the war years 1915 to 1918 imports were at a minimum. While this imported seed and our vetch seed belong to the same species (*Vicia sativa*) they are varieties different. In fact, the imported seed has represented many varieties, a number of which are inferior for use in this region on account of lack of winter hardiness. Oregon-grown vetch seed, which is one of the most winter hardy of the common vetch strains and which has been acclimated by years of growing in this region, is recommended for local use.

**Climatic adaptation.** Common vetch will stand any ordinary climatic conditions likely to be experienced in Western Oregon. The lowest temperature recorded at this Station during the vetch growing season was  $-14^{\circ}$  F., but as there was heavy snow cover, no soil freezing took place, and there was no damage to the vetch. Without snow cover, it is likely that zero temperature and, under some conditions, even higher temperatures would result in winter killing. Where winter temperatures are commonly as low as  $10^{\circ}$  to  $12^{\circ}$  F. without snow protection, it is doubtful if vetch will prove profitable.

In the winter of 1924-25, with but little snow cover, a temperature of  $-8^{\circ}$  F. resulted in considerable winter killing of vetch in several districts of Western Oregon.

The vetch showed more winter resistance than Gray oats or Foisy and Rink wheat and O. A. C. No. 7 Winter barley.

Extreme fluctuations in temperature and continued freezing and thawing are usually detrimental to the growth of the plants.

For the most successful production of vetch, a mean monthly minimum temperature of from  $32^{\circ}$  to  $40^{\circ}$  F. and a mean maximum monthly temperature of from  $45^{\circ}$  to  $75^{\circ}$  F. during the growing season, with an annual rainfall of thirty inches or more, quite evenly distributed throughout the fall, winter, and spring months is most desirable.

Table I shows the varying climatic conditions under which the experimental data in this bulletin were obtained.

TABLE I. SHOWING PRECIPITATION AND TEMPERATURE CONDITIONS AT CORVALLIS, OREGON, FOR YEARS 1914 TO 1924 INCLUSIVE

*Year	Total rainfall	—Temperatures in Degrees F.—		Days below $32^{\circ}$ F.
		Minimum	Maximum	
1914-15	30.60	13 - Dec. 21	97 - Aug. 28	38
1915-16	52.40	14 - Jan. 23	99 - Aug. 25	53
1916-17	33.96	8 - Jan. 19	103 - July 14	61
1917-18	41.67	21 - Jan. 31	99 - Aug. 25	34
1918-19	46.49	17 - Jan. 14	101 - Aug. 18	50
1919-20	32.62	-14 - Dec. 10	101 - Aug. 20	81
1920-21	41.25	24 - Nov. 11	95 - Aug. 7	34
1921-22	37.50	14	100	86
1922-23	41.64	16	96	76
1923-24	30.39	10	100	49

\*Years represented as crop years from October 1 to September 30, inclusive. Data from Oregon Experiment Station Weather Records.

Vetch is a thrifty grower and requires abundant moisture during its growing season. Good early fall moisture gives the seedlings a good start, they go into the winter in a vigorous, healthy condition, and are better able to withstand more extreme climatic conditions. During the late spring, growth is very rapid and much moisture is needed to make maximum forage crops.

Vetch is not a dry land crop, and in sections where the rainfall is under twenty inches annually, its production is impracticable.

**Soil requirements.** Vetch usually grows best on the medium to slightly heavy soil types of good drainage. Most of the reasonably good and fairly well drained lands in Western Oregon that may be farmed in good season, and that are kept free from surface water will produce vetch crops successfully. The better the condition of the land as to fertility and drainage, the larger will be the amount of crop produced.

Excellent crops of vetch are being produced on some of the red hill lands, and on the sandy, silty, and clay loams. The white lands and even some of the black, sticky types, when given adequate drainage, also produce good crops. Surface drainage often suffices, but doubtless under-drainage is preferable.

Drainage is essential to successful production of Oregon vetch. It does not grow successfully on wet land. Lands so poorly drained as to be saturated or have water standing at or on the surface so that the rooting systems are submerged for from one to four months in the year are of no value for the successful production of this vetch.

**Preparation of seed-bed.** The two general methods of seed-bed preparation for Oregon vetch are: (1) plowing and preparing a seed-bed by the usual cultural methods; and (2) "disking in." Each system has its special adaptations determining its use.

(1) Plowing for vetch is usually done on land that has been in winter grain, fall-seeded forage crops, pasture lands, or sod, or is otherwise hard or weedy. Early fall plowing is always preferable. Where time, power, and machinery permit, dry or summer plowing is very often advisable. It makes possible the preparation of the seed-bed soon after the early fall rains, and allows earlier seeding, which in general has been found to be profitable. Where it is not advisable to dry plow, the land should be put into seed-bed condition as early in the fall as possible, after the first fall rains.

**Disking cheaper.** (2). Disking for vetch is usually practiced where the land has been fallow, or has been spring plowed and has produced a cultivated crop, such as corn, beans, or potatoes, or has been in spring grain. The land under these conditions is usually free from weeds and is in comparatively good condition. A thorough disking will then fit it for a vetch crop. In some cases the seed is drilled in without previous disking. The advantage of this system is that, since one plowing does for two crops, a large amount of labor is saved. The land can be prepared and the seeding done early in the fall so that the seedlings have a better opportunity for large fall growth. Some growers believe that the firmer seed-bed and the stubble bring vetch through the winter in better condition.

Very often after disking the land it is advisable to harrow, especially where the land has been cultivated, as this levels the land some-

what and makes the seed-bed more uniform. Cross-harrowing is generally best.

Occasionally land that during the preceding season has produced a fall sown grain crop is disked and seeded to vetch. This is usually a poor practice. Under ordinary conditions the land is hard—often weedy, and it is very difficult to get a good seed-bed. This practice can occasionally be followed successfully on mellow soils reasonably free from weed trouble.

A "disked in" practice sometimes followed on land that has been cultivated or in spring grain is to seed the vetch broadcast before disk-ing and disk the seed in. On land in good tilth and free from weeds this practice is usually successful, especially if done early in the fall.

Where vetch is to be used as a green manure and cover crop in orchards that have been well cultivated during the summer, no further soil preparation is necessary before sowing the crop.

**Inoculation.** For best results with vetch the plants must be inoculated. They must have the nodules caused by nitrogen-fixing bacteria on the roots. Most of the lands in Oregon suited to the production of vetch, except in some of the Coast sections, contain the necessary bacteria and do not require artificial inoculation. In the newly developed farm areas, the soil may not contain the necessary bacteria, and in such cases it is best to inoculate. This can be done through the use of pure cultures, by scattering inoculated soil from fields which have previously grown a crop of inoculated vetches or by mixing such soil with the seed before planting. (Pure cultures are obtainable from the Oregon Experiment Station). Obtaining soil for this artificial inoculation is comparatively easy in districts where vetch is commonly grown. If sown broadcast over the field at least five hundred pounds of soil an acre should be used. This soil should be harrowed in promptly and not exposed to excessive sunlight. It appears that the inoculation with soil is most sure of success, but its cost is usually greater than that of pure culture. In the Coast section it is by far the better method.

**Time of seeding.** Approximately 95 percent of the seedings of vetch are made in the fall. Spring seeding is only resorted to during years or on soils when fall seeding is not possible.

Because of the moisture and possibly plant food required for the maximum development of this crop, fall seeding, which utilizes winter and early spring moisture, is always preferable. Vetches planted in the spring are at a disadvantage because they are not sufficiently advanced to utilize the abundant moisture of the early spring. During their late growth they usually suffer for moisture.

Planting should be done as early in the fall as possible. This will be as soon as a good seed-bed can be prepared after the first fall rains. It may vary from September 15 to November 1, and even as late as December 15. Seedings made early in October are usually best, and from November 1 to 15 have often proved successful. Late sowings are dangerous except where the soil conditions are favorable, uniform seeding possible, and winter weather mild.

Table II shows the hay and seed yields of vetch when seedings were made at various dates during fall and spring. The yields of hay in tons of dry matter show a decrease as the fall dates of seeding advance

toward December 1. In seed production, the yields also decrease as the dates of seeding advance toward December 1.

TABLE II. YIELDS OF VETCH HAY AND SEED FROM SEEDINGS MADE AT DIFFERENT DATES IN FALL AND SPRING

Harvest year	Seeding date	Hay yields		Seed yields an acre
		Tons an acre dry	Tons an acre dry matter	
		<i>tons</i>	<i>tons</i>	<i>bu.</i>
1914	Apr. 26	0.00	0.00	0.00
	Oct. 15	3.48	2.54	20.17
1915	Nov. 3	4.34	3.28	27.16
1916	Feb. 22	3.11	2.30	28.16
	Mar. 18	3.07	2.32	23.99
	Apr. 4	1.65	1.24	12.41
	Apr. 16	0.00	0.00	0.00
	Nov. 10	3.13	2.23	16.08
	Nov. 30	2.97	2.10	18.16
1917	Feb. 11	3.81	2.67	17.00
	Apr. 6	.50	.35	3.66
	Oct. 3	1.74	1.24	0.00
1918	Feb. 14	0.00	0.00	0.00
	Apr. 4	0.00	0.00	0.00
	Oct. 29	4.37	3.20	29.66
Averages:				
	Early spring seedings	2.49	1.81	17.28
	Late spring seedings	.43	.31	3.21
	Fall seedings	3.33	2.43	18.70

The early spring seedings, especially those made in February, were successful except during 1918, when aphids destroyed the crop. A seeding made in March, 1916, was good, but it will be recalled that there was good summer rainfall that year.

Early spring seedings produced successful crops, although not as large as fall seedings.

Late spring seedings in general were failures. The crops produced were very small. Generally speaking, seedings of vetch made after March 10 will not produce worth-while crops at Corvallis. In the lower Willamette Valley and Coast counties having a larger amount of late spring rainfall, slightly later seedings may be made.

Vetch does not make good growth during warm, dry weather. Aphids often damage spring seeded vetch.

**Rates of seeding.** Vetch was sown in these trials at the rate of 40, 60, 80, and 100 pounds an acre alone, and with 40 pounds an acre of Gray Winter oats.

Rate of seeding trials of vetch sown alone varied from 40 to 100 pounds per acre. All of the rate seedings were made in the fall and as near the optimum time of planting as was possible.

Table III shows the average hay yields for six years, and the average seed yields for five years when fall seeded alone. Both hay and seed yields show a gradual increase from the 40-pound rate to the 80-pound rate, and then a drop for the 100-pound rate. The 80-pound rate is the most profitable to use unless the seed is high in price.

TABLE III. RESULTS OF RATE OF PLANTING TRIALS WHEN VETCH WAS SOWN ALONE

Rate of seeding pounds per acre	Hay production (6 year average)		Seed production (5 year average) Bushels per acre
	Tons per acre field dry	Tons per acre dry matter	
<i>lbs.</i>	<i>tons</i>	<i>tons</i>	<i>bu.</i>
40	3.31	2.43	22.62
60	3.76	2.74	26.58
80	4.06	2.92	29.19
100	3.90	2.81	28.70

**Seeding mixtures.** Vetch may be sown either alone or with a companion crop. For forage, sowing with a companion crop is preferable, because it helps to prevent lodging and increases the yield. In years when insects or disease pests are prevalent, this companion crop very often acts as an insurance, as it is seldom materially injured, while the vetch sometimes suffers. Winter oats, winter wheat, winter barley, and winter rye are used for this purpose. For general purposes, winter oats is best.

Where the crop is to be used for special purposes such as a green manure or cover crop, silage, pasture or soiling crops, use the companion crop which is best suited for that particular purpose. For green manuring or cover crop purposes, barley and vetch or rye and vetch are considered best because of their rapid early spring growth. For silage purposes, generally a mixture of oats and vetch is used since any surplus may be cut for hay or seed. Some growers are using a mixture of wheat and vetch, claiming that it gives a slightly increased tonnage over a mixture of any of the other small grains with the vetch, and because the stiffer straw of the wheat allows less lodging. Winter barley and vetch are a good silage mixture but are poor for hay or seed. Winter barley reaches the hay stage about three weeks before the vetch, so that by the time the vetch is at the hay stage, the barley is ripe and worth little more than straw for forage. The beards are objectionable, being troublesome to the mouths of livestock.

**Separation of wheat and vetch difficult.** Where the crop is to be grown exclusively for seed production purposes, it is considered an advantage to grow the vetch alone. This is especially so when considered from the standpoint of seed cost, difficulty of separating vetch seed from the various cereal seeds, and yields. Oats is comparatively easy to separate from vetch and most ordinary machinery will separate rye from vetch. Wheat and vetch or barley and vetch are very difficult to separate because of their similar size, weight and shape, and special machinery is required to do efficient work.

Table IV shows the hay and seed production of vetch and oats seeded in combination at different rates. In hay yield the 80-40-pound rate gives a very slight increase over that of either the 60-40- and 100-40-pound combinations, but when considered from the standpoint of financial outlay for seed the 60-40-pound rate is most economical. For seed production the 80-40-pound combination proved to be the best when yield of vetch seed is considered, and the 40-40-pound combination the best when yield of oats is considered.

The yield of vetch seed increases as the rate of vetch seeded increases up to and including the 80-pound rate, and the yield of oats seed decreases as the rate of vetch seeded increases. The lighter seedings produce the larger yields of oats. This is largely accounted for by the fact that the increased stands of vetch often choke out or lodge the oats.

TABLE IV. RESULTS OF RATE OF PLANTING TRIALS WHEN VETCH WAS SOWN AT DIFFERENT RATES WITH GRAY WINTER OATS

Rates of seeding, pounds per acre		Hay production 6-year average tons per acre		Seed production 5-year average bushels per acre	
Vetch	Oats	Field dry	Dry matter	Vetch	Oats
<i>lbs.</i>	<i>lbs.</i>	<i>tons</i>	<i>tons</i>	<i>bu.</i>	<i>bu.</i>
40	40	3.94	2.86	20.70	42.61
60	40	4.31	3.14	24.76	37.81
80	40	4.33	3.17	26.69	34.72
100	40	4.32	3.14	23.16	29.90

Two methods of seeding vetch are generally followed, namely, broadcasting and drilling.

Drilling is preferred because it gives more even and accurate distribution of seed and better covering. Drilling usually requires less seed an acre than broadcasting, although this point depends somewhat on the efficiency of the broadcasting and covering work.

Broadcasting is usually practised where only small, rough, or stumpy areas are to be seeded, where the farmer has no drilling machinery, or where a field that has been in a cultivated crop or a spring sown cereal crop is to receive only one disking and that to be after sowing. By some farmers broadcasting is considered to be a more rapid method of seeding because a larger area can be covered in less time and the power used for drilling can be used for covering the seed with implements that will cover more ground in the same time than will the grain drill.

**Sow medium deep.** Vetch when seeded with the ordinary grain drill is usually sown at a depth of from 1½ to 3 inches. There is no particular advantage in seeding deeper than 2 inches. If the land is in good cultural condition, the seedlings of vetch seeded as deep as 4½ inches will start and often reach the surface without any particular difficulty, but such a depth is not recommended. Very shallow seedings are not recommended because very often the young roots are not sufficiently deep in the ground at the time of heavy frosts to prevent the heaving soil from pulling up the young seedlings and destroying considerable numbers of them. Where broadcast seeding is practiced, the depth of seeding is

TABLE V. RESULTS OF SEEDING OREGON VETCH IN DIFFERENT WAYS AND AT DIFFERENT DEPTHS

Rate of seeding	Depth of seeding	Hay production		Seed production bushels per acre
		Tons per acre field dry	Tons per acre dry matter	
<i>lbs.</i>		<i>tons</i>	<i>tons</i>	<i>bu.</i>
80	Broadcast	3.44	2.44	19.96
80	Drilling	3.47	2.52	23.60
80	1" drilling	3.54	2.52	26.00
80	2" drilling	3.63	2.63	26.42
80	3" drilling	3.66	2.64	26.94
80	4" drilling	3.76	2.72	29.88

often very shallow, and it is on these acres that during severe weather the largest percent of plants is injured.

Table V shows the average hay and seed yields of Oregon vetch obtained by seeding in different manners at different depths. These figures show that broadcasting vetch seed does not produce the yields of either hay or seed that any manner of seeding with the drill does. The yields obtained from simply drilling without regard to depth did not produce as large hay or seed yields as did a definite depth of seeding.

Little difference in hay production is shown between the 2-, 3-, and 4-inch sowing.

**Germination and early growth.** Newly threshed Oregon vetch seed practically always has a high percentage of germination. It seldom falls below 97 percent. The percent of hard seed is very low, usually less than 3 percent. In germination trials carried on during the past nine years with seed grown during the various crop years since 1915, it has been found that vetch seed stored under ordinary good storage conditions for six years is reduced in percentage of germination so little that its crop-producing value is practically as good as that of new seed. The amount of dead seed in samples six years old averages 3 percent. Seed nine years old loses 25 percent in germination and the sprouts are weak.

Vetch seed germinates very rapidly. It usually takes from 6 to 10 days, and the young seedlings appear above the ground in from 14 to 16 days. The seedlings from spring sown vetch seed usually appear above the ground from 2 to 3 days earlier than the seedlings from the fall sown seed, because the ground at that time is usually warmer.

**Value of split seed.** Very often in threshing vetch seed there is a considerable percentage of cracked seed. It is claimed by some growers that 50 percent of this cracked seed will produce plants. In germination trials carried on with cracked seeds it was ascertained that in seed chips representing from one-eighth to one-half seed the germination was 7 percent. Where only half seeds were used the germination was 28 percent. Where chipped seeds (usually representing 50 percent or more of each seed) were tested the germination showed 84 percent.

Split vetch seeds usually are half seeds. The germ in about 50 percent of the cases is practically all on one half of the seed. In about 25 percent of the cases it is uninjured and will germinate. Under favorable conditions the majority of the germinating half seeds will produce plants.

**Hay harvest.** The date of harvesting Oregon vetch for hay usually comes between June 20 and July 10, and depends largely on the maturity of the vetch. The stage producing the largest amount of forage of the greatest palatability and highest nutritive value is the time when the lower pods are about two-thirds filled. At this time the plant usually has its last set of flowers, and is entirely green. The lodging is usually at a minimum for the amount of forage produced, and the product when handled and cured properly is light green in color, free from dust, and of pleasant aroma. The figures in Table VI show the average yields of Oregon vetch cut at various stages over a 5-year period.

TABLE VI. AMOUNT OF FORAGE PRODUCED BY VETCH AT DIFFERENT STAGES OF MATURITY, 1919-1924 INCLUSIVE

Stage of cutting	Tons per acre green	Tons per acre dry
	<i>tons</i>	<i>tons</i>
2nd set of flowers in bloom.....	11.27	1.99
Lower pods one-fourth filled.....	12.57	2.77
Lower pods filled .....	12.15	3.43

Average five-year yields.

When the vetch is grown with a companion crop the cutting of the crop for hay is usually regulated by the stage of maturity of the grain of the companion crop. It is recommended that the combination crop be cut when the grain is in the soft dough stage. In the case of winter barley and winter rye combinations, the lower vetch pods are generally less than half filled, while with the gray winter oats combination the vetch is at the proper stage for cutting. In the case of winter wheat, which is the latest maturing of the cereals, the lowest set of vetch pods will be filled and the second set will be three-fourths filled.

Where there is a comparatively small amount of lodging there is little difficulty in cutting vetch or vetch and grain with the ordinary mowing machine.

**Cutting "down" vetch.** Where lodging is heavy it is sometimes necessary for men with forks to follow the mower to remove large bunches or to help free the sickle if it becomes clogged.

An extra long dividing board or one equipped with an extra long and heavy pole is often very useful in making a clear path for the next round of the mower.

Vertical sickles attached to the outer end of the cutter bar have been tried at various times to aid in making a clean swath and to prevent clogging. These have not proved successful where the crop has been heavy enough to need any special dividing arrangement.

Where vetch is sown with a companion crop, there is usually less lodging, and cutting is considerably easier.

Vetch, under ordinary conditions, cures quite rapidly. To retain the color as well as the leaves and finer parts of the stems, it is necessary to shock in large shocks as soon as the material is dry enough and let it complete the curing there. Generally the cut material, after becoming thoroughly wilted, is windrowed and allowed to cure until ready to shock. After drying, it may be handled like any other hay, either being put directly in the mow or stack, or baled direct from the field. The latter method usually results in a loss of color and weight, because it must be very dry at time of baling if it is to keep in the bale. It should be stacked or stored as soon as possible after curing. This makes better and brighter hay.

**Harvesting for seed.** The most satisfactory time for harvesting vetch for seed is just before shattering begins. This is at the time that from three-fourths to five-sixths of the pods are ripe. When cut at this stage, the remainder of the pods are well filled, and will mature germinable seed in the shock.

In harvesting vetch for seed the crop should be handled rapidly and carefully to reduce shattering loss to a minimum. In most cases vetch

grown alone for seed is badly lodged and generally is quite difficult to harvest. To overcome this difficulty the use of lifter guards and swather are of distinct advantage. The lifter guards lift the material from the ground so that the sickle may have a comparatively clean field to cut. Swathing attachments, of which there are a number on the market, are also of great advantage in vetch seed harvesting. After the material is cut, this attachment rolls it behind the machine out of the way of the horses and machine on following rounds. Where a swather is not used, it is always advisable to follow the machine with forks and move the last swath so that the horses and mower will not run over and shatter the seed on the next round.

**Prevent shattering.** In any method of harvesting that is practiced, all possible precautions should be used to prevent shattering. Shattering not only causes loss of seed but causes considerable difficulty from volunteering. As soon as possible after cutting, the material should be shocked up in large shocks so that the immature pods may mature and shattering be reduced. Seed vetch in the windrow or swath, if handled after it is dry, is sure to shatter badly.

Vetch handled properly does not shatter very badly. If the crop is not cut until the last pods are ripe, the whole plant is practically dead and serious shattering takes place with handling or even with only a dry wind on a hot summer day. When seed vetch ripens in the field, the amount of shattering may be considerably reduced by cutting early in the morning or at any time when there is enough dew or moisture to make the ripe pods tough.

Some vetch seed growers use the binder in harvesting the crop. Where there is a small amount of lodging, or where the crop consists of a small amount of vetch in combination with a large amount of grain and the material to be bound is dry, the use of the binder is quite successful. The binder makes harvesting faster. If the material is not ripe and dry when bound, the bundles may heat and cause moldy seed. There usually will be considerable shattering, especially when the material is dry.

**Threshing.** To thresh vetch most successfully, the straw and pods should be thoroughly dry. Dry vetch threshes more easily, takes less power, and a larger quantity can be run through the machine in a given time.

Any ordinary threshing machine properly handled will thresh vetch successfully. Much depends on the management of the machine while in operation. In some cases the seed cracks quite easily and there is serious loss. Threshing conditions and seed conditions after threshing vary from season to season, and as a consequence the machine operator must adjust his machinery to the current conditions. Efficient threshing involves getting out and saving all the seed and doing a minimum of cracking. Speed of cylinder and number and set of concaves have much to do with efficient operation. Dry vetch may be threshed with a cylinder speed of 700 revolutions per minute and with all concaves removed and replaced with smooth blanks. Tougher vetch requires some concave teeth to hold the vetch while the cylinder teeth whip out the seed. Tougher vetch may also require a higher cylinder speed. Loss by blowing over with straw is easily avoided by proper wind adjustment.

**Avoid cracking seed.** Very often after harvest losses have been held to a minimum up to threshing time, heavy losses result from seed being cracked by the thresher. Often this loss is not shown by an inspection made at the seed spout. An inspection at the blower or immediately back of the sieves will often show considerable loss. More often vetch seed is crushed rather than cracked and the finer particles usually blow over. Losses of as much as 25 percent have been caused by some machines.

Cracking is usually caused by: (1) Too high a cylinder speed. (2) Too many concave teeth or concaves set too high. (3) Sharp corners on steel blanks or grate bars below and behind cylinder. (4) Screens clogged, or too much wind, so that much seed is reelevated to cylinder and rerun through the machine. This is often a result of too many concave teeth cutting the straw fine and of wrong wind adjustment. (5) Screw conveyors set so close to the trough in which they run that seed crushing takes place.

Where vetch has been grown with a companion crop, the same precautions should be taken for the threshing of this combined crop, as are taken for the threshing of the vetch seed. In practically all cases the vetch seed is the more valuable and is the crop that is most desired. Under ordinary conditions when taking these precautions, the seed of the companion crop will thresh in good shape.

**Value of vetch straw.** Vetch straw is usually considered to be of higher feeding value than any other kind of straw, unless it is pea straw. Where the vetch has been cut comparatively early and a considerable quantity of the green straw is combined with the drier straw and the curing has been done during fair weather, much of it will readily be consumed by stock. In many cases it pays to save this straw for the wintering over of sheep or feeder stock. If not used as feed, it makes an excellent fertilizer, used either as bedding for livestock or as a top dressing for land.

The value of vetch straw in comparison to grain straw as a fertilizer is indicated by the following figures. Vetch straw is higher in nitrogen and phosphoric acid than either wheat or oat straw and higher in potash than wheat straw, but only about one-half as high in potash as oat straw.

TABLE VII. FERTILIZING VALUE OF STRAW

Kinds	Pounds in 100 pounds straw		
	Nitrogen N	Phosphoric acid P <sub>2</sub> O <sub>5</sub>	Potash K <sub>2</sub> O
Vetch .....	1.00	0.25 (0.11P.)	0.65 (0.54K.)
Wheat .....	0.50	0.15 (0.07P.)	0.60 (0.50K.)
Oats .....	0.75	0.20 (0.09P.)	1.25 (1.05K.)

Poorly threshed straw may have considerable seed left in it, and there is likely to be volunteering. This is not detrimental where vetch, a cultivated crop, or another forage crop is to follow vetch, but with a grain crop, vetch is usually considered as inseparable foreign material and reduces the price of the threshed grain.

**Pasturing vetch.** Vetch is considered to be a very good pasture crop for all kinds of livestock, but especially so for cattle and sheep. It is very succulent and palatable and will stand considerable pasturing

without much injury when the land is not too wet. Green vetch will cause bloat in cattle and sheep. To avoid this, the stock not accustomed to it should not be turned on vetch pasture while very hungry or before the dew is off.

Occasionally vetch planted in the early fall will make a small amount of pasture during late fall and early winter. Pasturing vetch in the fall is not to be recommended generally because the plants may be weakened to such an extent that they cannot stand severe weather, or may be badly trampled if the land is wet.

Spring pasturing is always preferable. At that season the vetch is making a large growth and has the ability to recuperate rapidly. In ordinary years, it will average six inches in height by April 1, and at that time will make an abundance of excellent pasture. If the land at this season of the year is wet, it is best to pasture only with light stock, such as sheep and calves. Heavy animals will cause considerable puddling of the land and may also destroy many plants by tramping them out.

The extent of the pasturing depends altogether on the crop that is to be harvested. If the crop is to be used for a soiling, silage, or hay crop, it is best not to pasture very close and to take the livestock off the vetch early in May. If the crop is to be used as a seed crop, and proper pasturing methods have been practiced, the livestock can be kept on the planting until May 15 or 20. Some growers think it advisable to pasture vetch where the crop is to be used for seed production since it prevents the vetch plant from making such a large growth.

Pasturing of spring planted vetch usually prevents production of either hay or seed.

During years when the indications are that aphids will destroy the crop, it is an excellent plan to pasture it off as rapidly as possible. In some cases, this rather close pasturing will have a tendency to help destroy the aphids, and if they come under control early enough there is a possibility of still being able to harvest a crop for either hay or seed. Generally speaking, after very heavy pasturing to salvage the crop from aphids, good crops are not to be expected.

**Mixture with small grain.** About 75 percent of the acreage usually termed as having been seeded to vetch is seeded to vetch with a companion crop. The companion crop commonly used is winter oats, although winter wheat and winter barley are being grown to an increasing extent.

Where the crop is to be used as forage, it is advisable to sow with a companion crop because the production is greater, there is less lodging, harvesting is easier, and the companion crop acts as a sort of crop insurance, especially during years when the vetch is attacked by insects or disease.

The proportions of seed used in the vetch and grain combinations are usually on the fifty-fifty basis by volume. This means that where a bushel of vetch is used, a bushel of the grain in the combination also is used. This proportion generally gives a well-balanced combination and the resultant crop is usually about equally divided in proportion of vetch and grain.

Occasionally where the mixed crop is to be grown for some special purpose, different proportions are used. Many growers when producing the crop for use by horses, prefer to sow two parts of oats to one part

of vetch. This mixture seems more satisfactory for horses because it increases the roughage somewhat and reduces the protein. With vetch and barley for a silage crop, it is preferable to seed one and one-half times as much barley by measure as vetch. The barley grains are usually quite large, and if seeded on the fifty-fifty basis, the relative number of barley plants produced will be too small and may be further decreased by smothering out. For all general purposes, vetch and wheat and vetch and rye are seeded on the fifty-fifty basis by measure.

The mixtures should be made before seeding. Both are then planted at the same operation. A good way is to dump alternate proportions of the seed on a clean, smooth floor. Then mix by thoroughly shoveling over with a scoop shovel. After having been thoroughly mixed, the drill if properly set, will give in practically all cases almost as accurate a rate of seeding as if the various varieties of seeds were sown separately.

As shown by Table VIII, there is from 25 to 30 percent increase in yield of forage for all combination plantings of vetch and grain. The increase in yield is enough higher to make it almost out of the question to plant grains alone for forage in sections where vetch will grow successfully.

TABLE VIII. COMPARATIVE FORAGE YIELDS OF GRAINS, VETCH, AND VETCH-AND-GRAIN COMBINATION SEEDINGS

Crop	Rates of seeding, pounds per acre		Tons per acre green weight	Tons per acre dry weight
	Grain	Vetch		
	<i>lbs.</i>	<i>lbs.</i>	<i>tons</i>	<i>tons</i>
Gray winter oats .....	64	....	11.89	3.55
White winter wheat .....	120	....	10.61	3.42
White winter barley .....	100	....	9.67	3.14
Winter rye .....	84	....	9.37	2.91
Vetch .....	80	....	12.31	3.57
Vetch and gray winter oats .....	60	40	15.00	4.32
Vetch and white winter wheat .....	60	60	14.72	4.28
Vetch and white winter barley .....	60	50	12.23	4.10
Vetch and winter rye .....	60	56	15.61	4.76

All harvested at hay stage.  
Figures are for four-year average.

**Vetch as a hay crop.** Vetch alone or vetch with a companion crop, preferably oats, is considered by livestock men to be among the best of the legume or legume and grain hays. The hay, if properly handled and cured, is of a bright color, leafy, comparatively fine stemmed, and is high in nutrition and palatability. All kinds of livestock do well on it and will consume large quantities.

The analysis of vetch hay compares very favorably with red and alsike clover and alfalfa. It is higher in crude protein than either of the clovers or alfalfa, and is lower in fat than either of these hays. Table IX gives the analysis of these hays as made by Professor J. S. Jones, Chemist of the Oregon Station. Analyses are made on an air-dry basis on materials grown in the Willamette Valley.

TABLE IX. ANALYSES OF WILLAMETTE VALLEY HAYS

	Number of analyses	Water	Ash	Crude protein	Ether extract	Crude fiber	Nitrogen-free extract
		%	%	%	%	%	%
Alfalfa .....	9	7.92	6.91	12.55	1.09	30.90	40.63
Clover, Red .....	19	8.03	6.08	10.23	1.51	26.55	47.60
Clover, Alsike .....	8	8.21	6.90	9.28	1.26	30.62	43.73
Vetch .....	35	8.36	6.10	13.26	.97	25.80	45.51

The yield of vetch hay varies from 2.5 to 4.5 tons an acre in ordinary years and under ordinary cropping conditions.

Vetch hay is generally fed to dairy cattle in this state. A considerable tonnage is fed to beef cattle, sheep, and horses.

The market value in Oregon of good vetch or vetch and grain hay and good clover hay is practically the same. The price of vetch hay as usually quoted is often somewhat less than first grade clover hay on large central markets. Practically all dealers prefer to handle it to straight grain hay, mixed grass and clover hay, grass hay, or cheat hay. At present, there is very little shipment of vetch or vetch and grain hay from any producing district, although Coast dairymen are beginning to use it in quantity.

In rare instances vetch hay has been considered by farmers to be harmful to stock. This has been due to feeding over-ripe vetch hay to horses and to cows. It appears that the mature, or nearly mature, vetch seed fails to digest and accumulates in the digestive tract, resulting in irritation and occasional death. Vetch is therefore better hay at a less mature stage.

**Vetch as a seed crop.** Vetch when planted alone will usually produce as many pounds of seed per acre as a good crop of winter wheat would if grown on the same land under the same conditions. Where grown in combination with one of the cereals, the production of vetch seed is usually about one-third less than where grown alone. The difference in vetch production is made up by the production of the cereal, which in general is about two-thirds of the normal production of that grain when seeded alone.

The value of vetch seed during individual years varies considerably. The average price is about four cents a pound, while the price for various individual years has varied from two and one-half cents to twelve cents a pound. These two prices are extreme and depend on the production, local demand, outside market, and importations from foreign countries. In general, the market value of vetch seed is about three times that of wheat. It is an excellent seed crop to grow within market demands. Added to the cash value of the seed is that of the straw for fertilizer and feed and the addition of nitrogen to the soil made by this leguminous crop.

**Feed value of seed.** Vetch seed is principally used for seeding purposes. It has in a few cases been made use of as pigeon feed and is said to give good results. Vetch seed is not very palatable. Various trials have been made with it as a hog feed, either used whole or ground and fed alone, or mixed with some other foods, such as ground barley or oats. In some instances it has been cooked, and in others soaked for

feeding to hogs. Its feeding value for hogs is not considered to be nearly as high as that of the cereals, and for best results it is advisable to feed it with a mixture of grain. Where fed alone unground, it is of very little value and where ground or cooked and fed alone, it is only of value as a maintenance food.

**Vetch for silage.** The use of vetch as a silage and soiling crop is constantly increasing because of its ease of culture, its heavy production, and its palatability when used for either of these purposes.

When vetch is to be used as silage or green feed, it is best to sow it with small grain. Wheat, oats, or barley is good when it is to be used for silage, while wheat, oats, or rye is good when it is to be used for green feed.

The proper stage to cut vetch or vetch and grain for silage is at the time the lower pods are two-thirds filled, to filled. The crop, when cut at this stage, usually gives a maximum tonnage, and is sufficiently mature and yet succulent enough so that when it is put into the silo it ferments properly and produces a mildly acid, very palatable product. If harvested and put into the silo when rather immature, there is a probability of its becoming slimy and unpalatable. If cut when quite mature, it is sometimes hard to tramp the material in the silo solidly enough to exclude the air, and molding may take place. Palatability and digestibility may be reduced because of over-maturity, especially in the case of the seed, and extra large quantities of water are very often necessary when such over-ripe material is being put into the silo. The tonnage of rather mature vetch is considerably less than vetch cut at the right stage.

Vetch when siloed at the proper stage and properly handled in the silo makes an excellent quality of silage and many feeders consider it equal to corn. It makes excellent feed for dairy cattle, beef cattle, and sheep. In general, vetch silage is considered to be better than clover silage in that it is easier to preserve, is usually more palatable, and livestock seem to consume it more readily.

The data in Table X show that the chemical analysis of vetch and oat silage is not as good as that of corn silage. The yield per acre of vetch and oats is more than twice that of corn, and the cost per ton of silage about 45 percent less. The yield and cost of production figures balanced against the nutritive value show that a larger amount of nutritives can be produced at less cost per acre for vetch and oats than for corn.

These data should not imply that corn for silage should be eliminated for vetch and oats, because corn as a cultivated crop is necessary in many farm rotation systems.

TABLE X. COMPARATIVE YIELDS, COST OF PRODUCTION, AND CHEMICAL ANALYSIS OF VETCH AND OATS AND CORN SILAGE

Silage	Average yield per acre	Cost per ton of producing and siloing	Chemical analyses in percent						
			Water	Dry matter	Ash	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract
	<i>tons</i>		%	%	%	%	%	%	%
Vetch and oats .....	12.7	\$4.05	73.58	26.42	1.92	2.15	8.85	12.91	.60
Corn ....	5.4	7.05	74.68	25.31	1.35	2.27	5.27	15.74	.70

**Summer silage.** Vetch is one of the most useful crops for the production of summer silage. It can be put into the silo from June 25 to July 10 and is ready to feed at once. This provides succulent feed for livestock at the time when pasture is scarce and soiling crops are not readily available. By filling the silo with vetch in the summer and refilling with corn or sunflowers in the fall, the silo can be kept useful throughout the whole year, or when pasture is not available.

Silage making of vetch is similar to that of other crops. It should be hauled from the field as soon after cutting as possible, cut fine through an ensilage cutter, and tramped well in an air-tight silo. The addition of water is often needed if there is not enough moisture in the cut material going into the silo noticeably to moisten the hand. Water may be put on the cut material either as it is being blown from the machine into the silo or after it gets into the silo. The former method is the better where running water is available and where the motor has plenty of power.

Where vetch is cut into the silo very rapidly, there is considerable settling. After two or three days when most of the settling has taken place, it is often advisable to refill to make use of all the silo space.

**Green feed.** Vetch for green feed is usually available as a limited amount of pasture from April 1 to April 15 and an increased amount of pasture from then on. As a green feed crop, it is usually not ready for cutting before May 1. The amount of feed produced before that time is usually small in comparison to the amount that will be produced afterward. Vetch will produce the maximum amount of green feed from June 1 to July 10. During favorable seasons, it is possible to get a small second cutting or a small amount of pasture from the lands that have been cut over during early May.

When handled as a soiling crop, the material should be brought in fresh from the field each day because when piled up it heats very rapidly and decreases in palatability.

Vetch, or vetch in combination with a small grain, will yield from eight to fifteen tons per acre at the silage stage. The amount produced in the form of green feed or soiling crop depends altogether on the stage at which it was cut, and the yield may vary from three to fifteen tons per acre.

Recent trials of mixtures of the various cereals with vetch have shown that barley and vetch, when grown together, make a silage that is considerably higher in nutritive value than silage made from other small grains and vetch. The barley matures earlier than any of the other cereals and makes a larger percentage of grain in the silage. As the barley makes a smaller total growth and is more mature, the total tonnage per acre of barley and vetch is usually somewhat less than where another cereal is used.

**Vetch as a cover and green manure crop.** During recent years, vetch has been gaining increased recognition as a cover and green manure crop, especially for orchards, though probably of equal value for various other types of farming. Because of its rapidity of growth, winter hardiness, and the large amount of growth produced early in the spring, it is one of the best annual legumes to use for cover crop and green manure purposes in Western Oregon. It has a strong rooting system, increases

the amount of nitrogen in the soil, and when planted early prevents considerable soil washing.

To produce the largest amount of green material to plow under early in the spring, the seeding must be done as early in the fall as possible so that the plants will have an opportunity to make maximum early growth. In cultivated orchards, it is often possible to make this planting before September 1. On general farm lands, it is usually made from two to four weeks later. The largest growth for these purposes can usually be obtained by seeding between September 1 and 15.

Vetch as a cover crop may be seeded either alone or with a small grain. Usually it is preferable to seed it with a small grain because the amount of material produced is greater, there is less danger of winter killing, and the cost of seeding is usually less. Where the vetch is seeded alone, 60 to 80 pounds is usually sown, and where seeded with a cereal, a bushel of vetch and a bushel of the cereal are combined and seeded at the rate of 60 to 80 pounds an acre. For cover cropping, a mixture of either rye and vetch, or barley and vetch should be used instead of oats and vetch, because either rye or barley makes more early growth than oats and gives more green material to plow under.

**Early growth important.** To be profitable as a cover crop or green manure crop, vetch must make a heavy early growth. On valley loam and hill lands in Western Oregon to be cropped to field crop, it is best that the crop be plowed under between March 20 and April 1, so that there will be enough moisture in the soil for proper decay of the added organic matter. For orchard or small fruit purposes, an earlier plowing is necessary because of greater moisture requirement. If a green manure crop is plowed under too late, and the dry weather sets in, it may result in a reduced supply of moisture to the growing plants and cause detrimental instead of beneficial results during the first year.

Before plowing under a green manure crop, it should be thoroughly disked and cut up as fine as possible. This will aid considerably in turning under and will hasten the processes of decay.

The value of either a cover or green manure crop depends largely upon the type of crop used, the amount of material and the time it is turned under. It is estimated that a growth of vetch or vetch and a cereal at the time of plowing, averaging ten to twelve inches in height, will be as beneficial to the land as ten tons of manure.

It is good practice to give a light application of land-plaster to vetch to stimulate it into increased growth early in the spring, so that a larger tonnage may be available for turning under for green manure or other early growth purposes.

**Vetch in rotation.** Vetch is a comparatively easy annual legume to work into a rotation. In Western Oregon it will successfully follow any other field crop on any type of reasonably well drained land.

Vetch grown for seed is not recommended in a two-year rotation with grain, especially wheat, because the volunteering vetch produces an inseparable mixture and lowers the grade of the grain.

Vetch in rotation with a cultivated crop such as corn or beans can occasionally be used to clean land of weeds or prepare it for other crops.

A three-year rotation to include vetch allows diversity, includes a cultivated crop, and simplifies farming by reducing the number of operations necessary for the production of the three crops. This rotation

should include besides vetch, a cultivated crop such as corn, potatoes or beans, and a cereal crop. To avoid loss by the volunteering of the vetch, it should be followed by a cultivated crop which in turn is followed by disking the cultivated crop land and sowing to grain. Barnyard manure whenever available is very helpful and should be added to the land before the production of the cultivated crop.

During the past ten years, crop succession trials using vetch as the basis have been made on the Experiment Station. Five different crops were used, these being vetch, oats, wheat, corn, and potatoes. All the crop material produced by each planting was removed and only the roots and stubble, and in the case of the potatoes the tops, were left on the land. No fertilizer of any kind whatever was added. One series was seeded to vetch continually. The other four series were seeded on alternate years to vetch and to the various other crops mentioned, thus comparing vetch continuously with alternate cropping. Tables XI and XII show the yields of the various crops grown in this trial. The vetch crops produced for ten years on the same areas have shown a decline in yield not accounted for by seasonal conditions. This decline in yield is shown in both hay and seed and is especially pronounced in the latter case.

This indicates that vetch too should be grown in a rotation. While the reduction in yield is not so great as for unrotated cereal crops, there is an argument against such continued cropping at the present time in the tendency for an increase of wild oats. So far, there has been no detrimental effect from either disease or insect pests, but such trouble probably is more likely to develop in those plantings than in plantings where rotation has been practiced.

Where potatoes have been alternated with Oregon vetch on the same land with no fertilizer added, the yield of potatoes has decreased.

The reduction shown in potato yield is doubtless due largely to rather dry summers and to disease in the potatoes in 1923.

In the case of corn and vetch alternating, both crops have remained practically stationary in production. This also is the case with winter oats.

In the case of winter wheat alternating with vetch, the yields have been good. A comparison with Table I shows that the wheat was grown during years of good rainfall, but without doubt the vetch has had a very beneficial effect on the succeeding yield of wheat.

TABLE XI. EFFECTS OF CROP ALTERNATION ON PRODUCTION OF VETCH, WINTER OATS, WINTER WHEAT, CORN AND POTATOES

Year	Hay	§Vetch seed	Oats seed	Wheat seed	Corn fodder	Potatoes
	<i>tons</i>	<i>bu.</i>	<i>bu.</i>	<i>bu.</i>	<i>tons</i>	<i>bu.</i>
1914-15	3.38	25.83	66.72	*0.00	†0.00	138.00
1915-16	2.49	31.79	.....	.....	.....	.....
1916-17	2.26	23.24	84.21	37.79	7.67	193.00
1917-18	1.29	†0.00	.....	.....	.....	.....
1918-19	3.96	30.99	83.74	54.33	7.32	170.16
1919-20	3.37	21.83	.....	.....	.....	.....
1920-21	3.52	18.00	81.56	52.16	7.50	131.16
1921-22	2.14	19.16	.....	.....	.....	.....
1922-23	2.00	17.33	74.37	45.66	7.12	88.33
1923-24	3.02	18.16	.....	.....	.....	.....

\*Failure on account of smut. †No yield taken. ‡Failure on account of aphid.  
§Vetch continuously on same land. Other crops alternate with vetch.

The comparative yields of vetch hay and seed where grown continuously or alternated with oats, wheat, corn or potatoes, show a decline in yield where alternating with oats and wheat, and a slight increase where alternated with corn. There is very little difference in yield where vetch was alternated with potatoes, and where vetch was grown continuously.

TABLE XII. HAY AND SEED YIELDS OF VETCH GROWN CONTINUOUSLY OR IN ALTERNATION WITH OATS, WHEAT, CORN, AND POTATOES

Year	Vetch con- tinuously		Following oats		Following wheat		Following corn		Following potatoes	
	Hay	Seed	Hay	Seed	Hay	Seed	Hay	Seed	Hay	Seed
	tons	bu.	tons	bu.	tons	bu.	tons	bu.	tons	bu.
1914-15	2.43	25.83	.....	.....	.....	.....	.....	.....	.....	.....
1915-16	2.49	31.79	2.77	38.41	2.37	30.49	2.83	38.99	3.11	38.41
1916-17	2.26	23.24	.....	.....	.....	.....	.....	.....	.....	.....
1917-18	1.29	.....	1.09	.....	1.18	.....	1.45	.....	1.21	.....
1918-19	3.96	30.99	.....	.....	.....	.....	.....	.....	.....	.....
1919-20	3.37	21.83	3.01	23.33	3.15	23.66	3.64	18.49	3.10	19.33
1920-21	3.52	18.00	.....	.....	.....	.....	.....	.....	.....	.....
1921-22	2.14	19.16	2.04	21.33	2.23	17.99	2.28	18.66	2.25	21.00
1922-23	2.00	17.33	.....	.....	.....	.....	.....	.....	.....	.....
1923-24	3.02	18.16	2.64	19.33	2.65	18.66	2.83	21.33	2.98	27.83

No seed harvested in 1917-18 on account of aphids.

**Vetch seed cleaning.** It is not difficult to clean vetch seed from chaff, weed seeds, rye, or oats. Practically any of the ordinary cleaning machinery, well adjusted, will make a 99 percent separation. This, however, is not generally the case where wheat, barley or cockle and vetch are mixed, because the seeds of these plants are very nearly the same size and the same weight, and a screen that will let one of them through will also let the others through.

At present the only practical way of entirely eliminating wheat from vetch seed is by use of the inclined belt cleaner or the spiral cleaner. The spiral cleaner, while doing very successful work, operates slowly, and where there are large quantities of this material to separate it should be put through a screen cleaner beforehand so as to get rid of all dirt, chaff, and small, cracked, immature, or extra large seeds which may be in the lot.

The market demand for clean vetch seed is continually becoming more strict. Vetch seed that shows a purity of 98 percent usually presents no marketing difficulties, but if the purity is less, buyers usually discount heavily. A mixture of vetch varieties is considered by many buyers to be as bad as a mixture of grains. In practically all cases the different varieties of vetch are absolutely inseparable.

**Fertilizers.** Manure is of value in increasing the yield of vetch. Generally there is comparatively little manure used for the direct production of this crop because it is considered more necessary for other crops. It also tends to cause lodging of the vetch. As an indirect aid for Oregon vetch production, it is considered more profitable to use manure for a cultivated crop that may precede a vetch crop.

**Land-plaster.** Gypsum or land-plaster normally has a stimulating effect upon the growth of vetch. Its effect is especially pronounced where vetch is growing on land that is not particularly suited to the crop and where it has a tendency to make a slow growth. In some cases, especially on land that has been well farmed and is of average or above the

average fertility, applications of land-plaster have had comparatively little effect in increasing the yield:

Land-plaster, to be most effective, should be applied early in the spring at the rate of from 50 to 100 pounds an acre. The amount depends on the condition of the crop at the time of application and the use to be made of the crop. If the crop appears backward, a heavy application should be used, while if the crop is in good condition a lighter application will suffice. Under practically all conditions, it pays to apply land-plaster to vetch where the crop is to be used for production of forage. On lands in good physical condition and fertile enough to produce a normal crop of vetch seed, heavy applications of land-plaster should not be made, as it often will result in increased vegetative growth and less seed production.

Table XIII shows the comparative yields of hay and seed obtained from vetch grown on land treated with gypsum and ground limestone and from checks.

This trial was continued for four years, during which time the same areas of land were used for each trial. In the case of the limestone applications, this meant that where 2,000 pounds were added yearly after four years a total of 8,000 pounds had been added. During the period of these trials all crop material was taken off the land and no animal or organic fertilizer other than a small amount of crop refuse was added. Four hay crops and three seed crops were harvested. The fourth seed crop was destroyed by aphids.

The figures in general show a slight increase in hay yield by the use of gypsum and limestone. Where gypsum was used, no advantage was gained by using more than fifty pounds per acre. The 50-pound application of gypsum and the 1,000-pound applications of limestone gave increased seed yields, while land given the other rates of application showed decreased yields. In the case of gypsum, the heavier applications probably caused vegetative growth to be made at the expense of seed production.

TABLE XIII. EFFECT OF GYPSUM AND GROUND LIMESTONE ON YIELD OF VETCH

Fertilizer used	Amount applied per acre	*Hay yield			†Seed yield
		Tons field dry per acre	Tons air dry per acre	Tons dry matter per acre	
	<i>lbs.</i>	<i>tons</i>	<i>tons</i>	<i>tons</i>	<i>bu.</i>
Check .....		3.00	2.37	2.17	27.66
Gypsum .....	50	3.14	2.53	2.23	27.86
Gypsum .....	150	2.98	2.40	2.12	26.14
Gypsum .....	300	3.16	2.52	2.21	24.86
Ground limestone .....	1000	3.11	2.51	2.18	28.39
Ground limestone .....	2000	3.22	2.59	2.26	27.18

\*Average of 4 years yields.

†Average of 3 years yields.

The experiment showed paying results from the 50-pound application of land-plaster for two years, but it appeared that with even this light application, sufficient improvement in soil conditions had developed in this time so that the land-plaster was no longer necessary.

Lime did not pay in any phase of the experiment, and it is doubtful if it is economical to use it on vetch on the gray or lighter valley soils. Vetch appears rather tolerant of slightly acid soil conditions.

INSECT PESTS, ANIMAL PESTS AND DISEASES  
OF OREGON VETCH

Vetch is comparatively free from insect and animal pests and the various diseases which attack many of our field crops. There are a few which occasionally do considerable damage. The insect pests are largely confined to aphids and slugs. The animal pests are generally field-mice. The diseases are stem rot and leaf spot.

**Aphids.** Aphids are more troublesome on certain legumes, such as field and garden peas and different varieties of vetches than on most ordinary field crops. Their serious attacks upon these crops are not a yearly occurrence, but come at intervals. During the years of 1912 and 1918, the most serious attacks upon vetch took place, in 1918 practically destroying the crop.

Aphids winter over in the adult stage, usually in waste material or grass and weeds along fence rows and similar places. If the climatic conditions have not been sufficiently severe during the winter to kill them, they attack the young plants as soon as the weather warms up sufficiently and at once begin multiplying. Multiplying very rapidly if not checked they soon increase to large numbers and do considerable damage.

*No practical control.* The control of aphids on vetch is very difficult, and control measures applied to date on vetch have not been successful. Vetch fields are usually quite large, the growth is dense and often rank, and it is seldom that more than 50 percent of the plants may be reached with destroyers or repellants as usually applied.

Several sprays and poisonous dusts have been tried under various conditions. In general, the results obtained have not paid for the cost of the material and its application. Smudging by the use of a heavy smoke produced by burning wet straw and the use of sulfur fumes have also been tried without success. Various mechanical devices have been tried out, but have not proved worth while.

The artificial methods used for the destruction of aphids on vetch are costly, especially where chemicals are used, and from the results so far obtained, their use is not practical. Mechanical means, were they perfected so that in one or two operations over a vetch field the majority of the aphids could be destroyed, probably would be quite successful, but with all the devices used up to the present time the fields generally have to be gone over so many times that the mechanical injury to the plant is considerably greater than the benefit.

At present nature offers the only satisfactory means of combating aphids on Oregon vetch. The ladybird beetle, commonly called "ladybug," and its larvae are natural enemies of aphids, and when they occur in normal numbers will usually control the situation very well. Occasionally there are years when the ladybird beetles are scarce, and it is during these years that aphids often do considerable damage. Another insect, the larvae of the surphid fly, also consumes large numbers of aphids.

Attempts have been made to transfer ladybugs from their natural winter habitat to vetch fields earlier in the season than they normally come. This has not proved satisfactory because they do not remain in the vetch field.

The best farm control measure for aphids is clean farming. This means the cleaning up of all rubbish piles, the mowing or burning out of old fence rows, and destroying all other winter quarters of the adult insects.

Aphid attacks on vetch are easily recognized, and whenever the owner of a vetch field sees that his crop probably will be destroyed before either hay or seed harvest comes, it is best to make use of the crop as forage immediately. If the crop is not large enough to make it possible to harvest for soiling purposes, silage, or hay, it should be used immediately for pasture. Rapid pasturing is necessary because as the number of aphids increases, the palatability of the vetch decreases.

If the attack is early and the crop is not large enough to make pasture, or it is not desired to use it for pasture, it can be made use of as a green manure crop to be plowed under and followed by a cultivated crop.

**Slugs, a new pest.** Another pest which during the past year has attacked vetch in some areas is the common garden slug. The attacks up to the present time have been somewhat localized and in small areas. The attacked areas have been mainly in the vicinity of trash piles, or unkept fence rows, or along other adjacent uncultivated or grass areas. The matter of control generally resolves itself into the cleaning up of these waste places, destroying the natural habitat of the slugs.

Only a small amount of work has been done toward the control of slug attacks in vetch fields. The only remedy that seems to be of any particular value is the use of copper sulfate, either as a liquid spray or in the very finely powdered form and used as a dust directly on the insects themselves, or on the plants or soil which they are apt to travel over within a comparatively short time after application. It is estimated that as a dust 45 or 50 pounds an acre is sufficient, and that when used as a spray, a mixture of 1 pound of copper sulfate to 100 gallons of water will prove of sufficient strength to kill the slugs.

**Animal pests.** During occasional years, there is considerable trouble in vetch fields with field-mice. The mice will destroy the vetch and grain seeds and seedlings. They usually live in colonies near uncultivated areas and destroy considerable areas of vegetation near by. The most efficient control method is the use of poisoned grain.

**Diseases.** The two diseases which attack vetch are stem rot and leaf spot. These diseases are seldom serious, but there are occasional areas and occasional seasons when the attacks are serious enough to be noticeable.

**Stem rot.** Stem rot, as its name indicates, is a rot on the stem or root of the vetch plant, usually occurring near the ground, but may occur anywhere on the stem, especially where the stem is in contact with the ground. It is a fungous disease and seems to thrive best under moist, warm conditions where the air circulation is poor. It usually attacks the plants in the fall, or comparatively early in the spring, and the most serious attacks are usually centered where the vetch has made a very rank growth and lodged considerably. It is apparent that the only practical control method to be used is to prevent excessive early growth of the vetch crop, so as to reduce lodging. This may be done either by

practicing later fall seeding, or by making use of the increased early growth for pasture and by a grain support.

It seems probable that this disease might remain over in the ground from year to year, consequently it is advisable that areas attacked by the disease should not have vetch seeded on them for at least two years after the year of attack.

**Leaf spot.** Leaf spot, another fungus disease, causes a small brown spot, generally on the leaflets, but sometimes on stems and pods. These occasionally become so numerous that parts of the plant may turn a reddish brown color and many leaves fall off. Pods which have been attacked by this disease usually produce small, shrunken seeds which are hard to thresh. Leaf spot is of minor importance, and unless exceptionally severe, seldom reduces a forage yield. Occasionally when the pods are attacked, the yield of seed is reduced. There is no specific control method for the checking or elimination of leaf spot. If the indications are that the seed crop is to be damaged to a considerable extent by this disease, it is advisable to harvest the crop for forage instead of seed.

### VARIETIES OF COMMON VETCH

The general name, Common vetch, covers a large number of varieties and strains. Some of these varieties are very distinct and are easily segregated. Others have only minor differences, and considered commercially all come under the same class.

During the period of the vetch investigational work at this Station, a large number of varieties and strains of Common vetch have been grown for comparison with the commercial variety of Common vetch. Most of these have not shown any particular advantage over this variety, and there have been some that were not as good. There have been a few varieties which have shown up rather conspicuously. After several years' trial, these have proved to be well suited, not only to the usual uses for Common vetch, but to other specific cropping advantages. The best of these types are *Vicia sativa* 13420, *Vicia sativa* 13430, *Vicia sativa* 02831, and Pearl vetch.

**Vicia sativa 13420.** This is the highest producing of the most winter hardy varieties of Common vetch. In Oregon there is comparatively little difference in winter hardiness of the different varieties, but in sections having more severe climates, the factor of winter hardiness is often the determining factor as to whether or not the crop shall be grown.

In plant characteristics this variety differs very little from the ordinary Common vetch. Its date of maturity is usually about one week later. Cultural practices for growing this variety are the same as for Common vetch. Forage and seed yields are equal to those of Common vetch.

**Vicia sativa 13430** is the earliest maturing variety of Common vetch, and for that reason is of particular advantage to those desiring an early pasture or soiling crop, or to the grower of cover or green manure crops. As a hay crop, it may be at a slight disadvantage in that its hay stage comes comparatively early, and during some years may be at that stage

during the rainy season. In plant characteristics it differs very little from the Common vetch. The seeds of this variety are easily distinguished from Common vetch in that they are considerably lighter in color. The seeds are light mottled brown instead of the usually dark mottled brown or gray colors of the Common vetch. The color of all seeds is uniform. The same cultural practices for the growing of Common vetch are used for this vetch.

**Vicia sativa 02831.** This is probably the latest maturing strain of Common vetch, and is also probably the largest grower. While its period of maturity is late, its rank growing habits give it the ability of producing as large an amount of pasture or other green feed material as early in the season as Common vetch. Its botanical characteristics are very similar to those of the Common vetch, except for the increased size in stem, leaves, pods and seeds, and color of seed. It is finely mottled, bluish gray.

**Pearl vetch** is very similar to Common vetch and at present in some sections is grown as a forage and seed crop. This type differs somewhat from the Common vetch in that the seeds are of a distinctly light pink color and are generally somewhat flattened. The growth is not quite so large. Pearl vetch has shown itself to be the best variety for early spring planting, and will practically always produce a crop, when sown at that time.

The seeds of all varieties of Common vetch are usable for human food. The seed of Pearl vetch is most often used because of its more presentable color and probably also because of its thinner seed coat. When cooked or baked in a similar manner to navy beans, it has a similar taste and appearance, and some people make little distinction between them for table use.

A selection of Pearl vetch, 31084, has during several years' trials proved to be a higher producer than the commonly grown type.

**Vicia sativa 18805** is practically immune from aphid attacks, and during years when aphids were very serious on other types of vetch, this strain remained practically free and produced good crops. In habit of growth, it differs very little from the Common vetch. The same cultural practices used for the Common vetch are applicable to this strain. In botanical characteristics it differs somewhat in that the flowers are pink; the growth is usually not quite so rank; the plants set seed more freely, and the seeds are somewhat angular, reddish brown in color and about one-half the size of Common vetch seed. It is not as hardy as Common vetch.

## VETCH BREEDING WORK

During the years that the vetch trials have been under way, considerable work has been done in the selection of strains of this vetch to secure improvements.

Crossing the various varieties of vetch has proved a difficult problem, and attempts along this line have been failures.

The most progressive work in the breeding of vetches has been done by selection and at present several very good strains are under observa-

tion which show evidence of being superior to those now grown. The number of selections that may be made from Common vetch are practically unlimited because of the great variations that occur. The final problem remains to select and test those which show an improvement over the original strains.

The *Vicia sativa* 13420, 13430, 02831, 31084 and 18805 are the results of selection, and at the present time are considered to be the best five from approximately 1,000 selections.

Considerable work was done at the Oregon Station in selecting types of Common vetch for high protein content. There is a difference in protein content of various types. The higher protein content is usually associated with small plants and when the crop was taken as a whole and acre yields considered, the amount of protein per acre of vetch was not increased.