

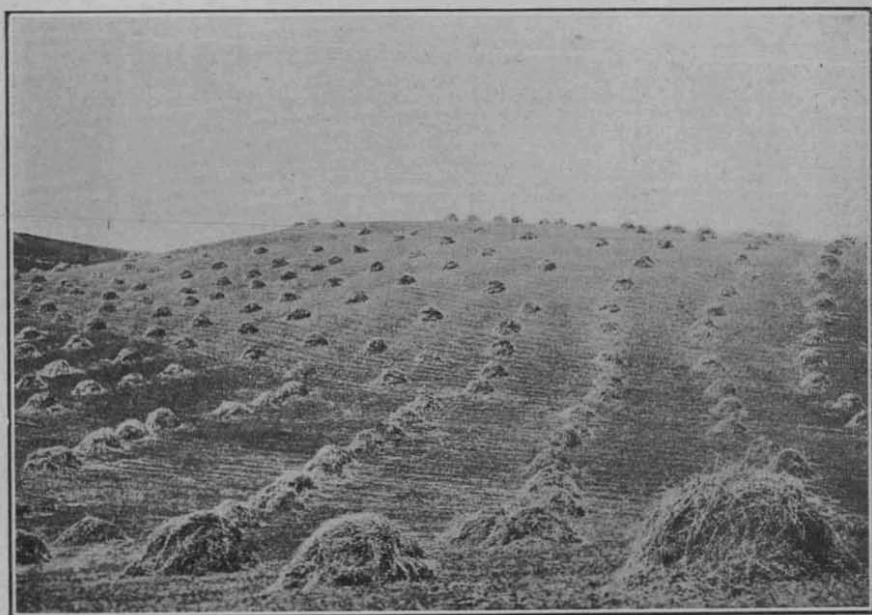
UNIVERSITY OF IDAHO  
AGRICULTURAL EXPERIMENT STATION  
Department of Farm Crops

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# Forage Crops For the Non-Irrigated Lands of Idaho

By  
R. K. BONNETT



Alfalfa Grown in the Palouse

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## FORAGE CROPS FOR THE NON-IRRIGATED LANDS OF IDAHO\*

Idaho, with its fertile farms and abundance of forest range, is primarily a live stock-producing state, but forage crops must be grown for roughage if the live stock industry is to be profitable. Farmers in the irrigated regions of the state have little difficulty in growing an abundance of forage, but the problem is more difficult in the non-irrigated regions. In such areas, forage is usually deficient. As an exclusive grain system of farming is replaced by diversified farming, the need of an adequate supply of forage becomes more urgent.

While certain forage crops are adapted to the climatic and soil conditions in the drier regions of the state, the success of the crop depends largely on cultural practices. The growing of hay crops for market on the non-irrigated lands is not to be encouraged, because usually other "cash" crops will produce greater returns. However, these forage crops will produce good profits when fed to live stock on the farm, if, at the same time, the residue from other crops and grain of inferior quality can be utilized. Some forage also is necessary on the average grain farm to supply the work animals with pasture and hay. Such crops can generally be grown at less expense than they would cost shipped in from other regions.

### PERENNIAL GRASSES

Many of the perennial grasses are successful as permanent hay or pasture crops in the non-irrigated areas of the state. Timothy, orchard, redbtop, brome, tall meadow oat, Italian rye, perennial rye, and slender wheat grass, are all valuable for use in hay and pasture mixtures. Kentucky Bluegrass is primarily a pasture grass and is not well adapted to hay production.

*Timothy* thrives best on fertile, well-drained soils. It grows in bunches, producing erect stems with bulb-like enlargements at the base. Under favorable conditions, it makes a heavy growth early in the season, but the aftermath is usually very light. Timothy is not a heavy producer, except when grown on the heavier bottom lands that are subject to overflow and sub-irrigation.

*Orchard* grass is one of the most important grasses for dry lands as

\* In preparing this publication the author has made use of data collected by G. S. Ray in 1917 and H. W. Hulbert in 1918. He acknowledges the assistance and advice of H. W. Hulbert, L. C. Aicher, and B. F. Sheehan in preparing the manuscript.



TYPES OF GRASS HEADS, REDUCED ONE-HALF 1. Timothy 2. Tall Oat 3. Orchard 4. Brome 5. Red Top.

it produces heavy yields under moderately dry conditions. It is a very bunchy grass, starting growth early in the spring and producing a heavy aftermath. It is more desirable for pasture than for hay, as it becomes woody a short time after blooming and must be harvested as soon as possible after that stage to produce a good quality of hay.

*Redtop* is a fine-stemmed grass producing a firm sod and is well adapted for both hay and pasture. It has a wide range of adaptability to climatic and soil conditions. Redtop produces the heaviest yields in wet soils and will often yield better than other grasses on gravelly dry soils. It is very hardy and will withstand low winter temperatures or drouthy periods during the summer. There are many localities in the state where native species of redtop grow wild and are very productive.

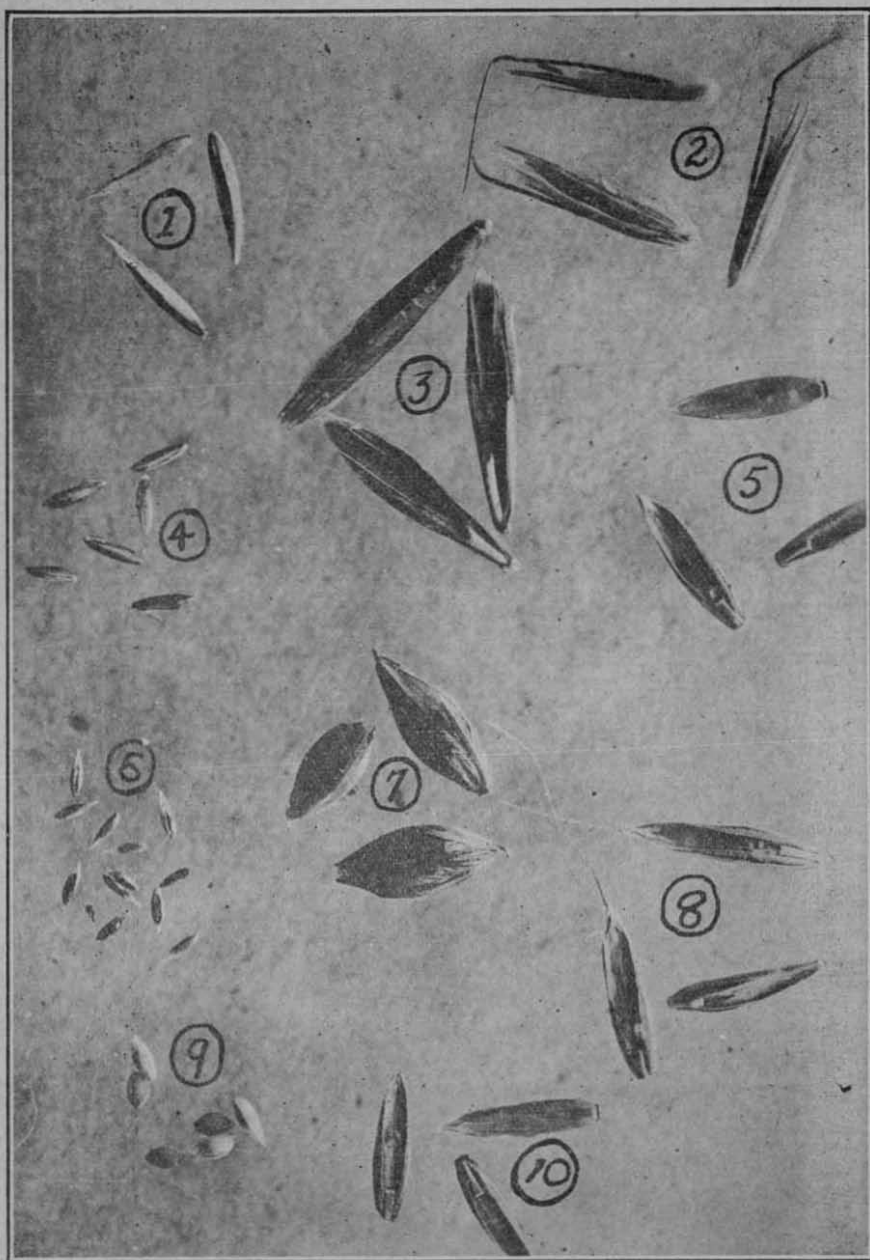
*Brome* thrives well under arid conditions in Idaho. It is an excellent pasture grass, and can be harvested for hay, but it has one disadvantage in becoming sod-bound after a few years and the sod must be broken in order that the grass may remain in a productive condition.

*Tall Meadow Oat* grass has not been grown as extensively in the United States as in Europe, owing to the high price and scarcity of seed. A hot climate and dry conditions are most favorable to this grass, which will produce larger yields than timothy on poor and light soils. It is a long-lived perennial producing good yields for from six to eight years and grows in bunches.

*Perennial* and *Italian Rye* grass grow best where the winters are rather mild, and should not be grown at the higher altitudes. These grasses will usually survive under conditions similar to orchard grass. They are short-lived perennials, living from three to five years, especially when shaded by other grasses in a mixture. They are valuable in mixtures to furnish hay and grazing the first season and also for grazing during the late fall and winter.

*Slender Wheat* grass is a native of the Great Plains region. It is drouth-resistant and fairly productive. Light, well drained, soils are most favorable and the yields produced will correspond closely to those from timothy. Slender Wheat grass grows in bunches and produces long slender heads and a fine quality of foliage.

*Kentucky Bluegrass* is not suited to hay mixtures and should not be included unless the aftermath is utilized for pasturage. This grass produces a heavy sod and a large number of fine leaves which have a high nutritive value. It starts very early in the spring and furnishes forage during the latter part of the season, but is not productive during the drier months of the summer. *Canada Bluegrass*, a closely related species, is more hardy and resists drouth, but is too coarse and wiry to be very valuable for pasture purposes.



TYPICAL GRASS SEEDS ENLARGED X 4.

1. Orchard 2. Tall Oat 3. Brome 4. Kentucky Blue 5. Meadow Fescue  
6. Red Top 7. Sudan 8. Italian Rye 9. Timothy 10. Perennial Rye.  
(Original).

## LEGUMES

Legumes should be grown in combination with grasses for hay and pasture. They increase the yield of forage and at the same time increase the feeding value of the crop and improve the fertility of the soil.

*Medium Red Clover* or *Red Clover* is the most valuable clover for both hay and pasture under non-irrigated conditions. It is a biennial, that is, it lives only two years. Usually it is grown with timothy for hay purposes, as both mature at about the same time and grow well under similar conditions.

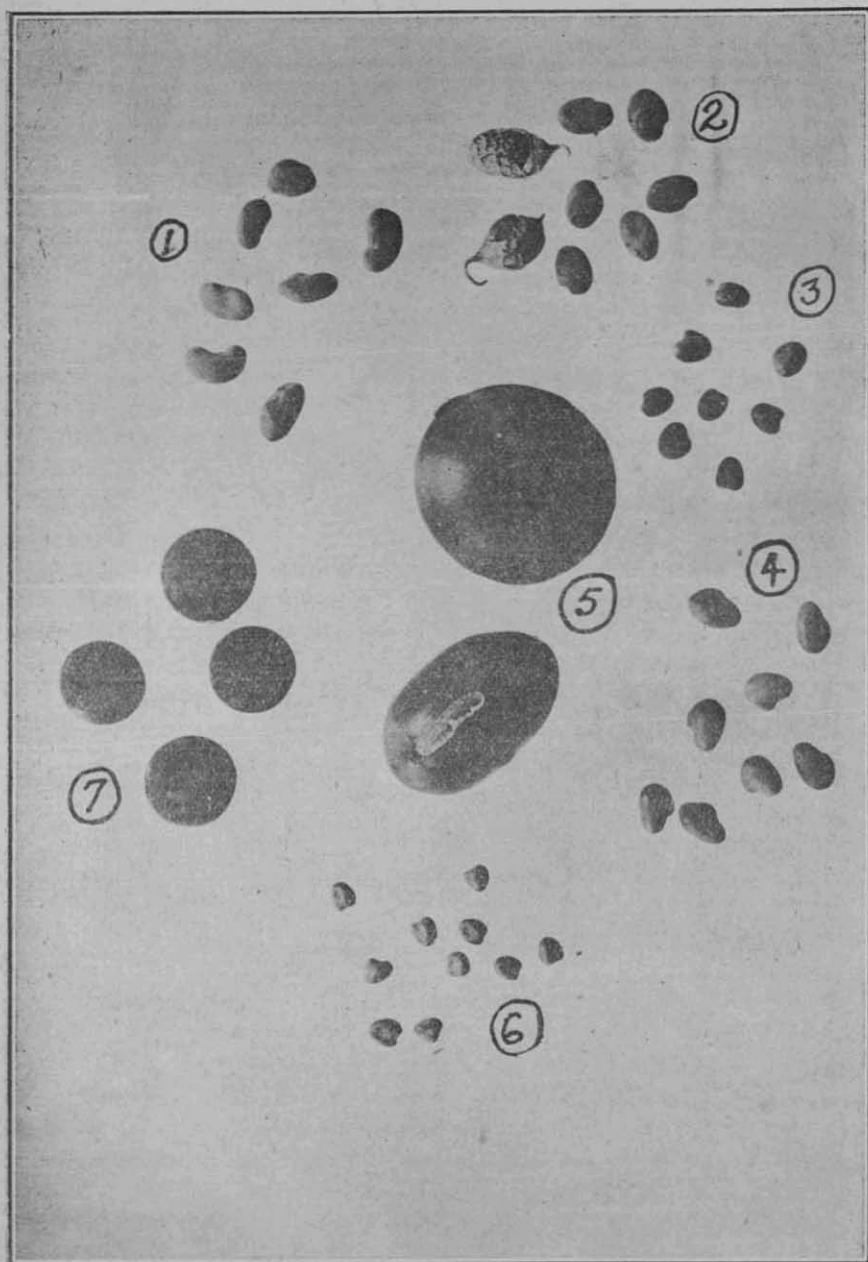
*Alsike Clover* is a short-lived perennial, but will not produce as good yields as red clover under drouthy conditions. It has a more shallow root system, and thrives best on moist soils. As it matures later in the season than red clover, it seldom produces an aftermath of any value.

*White Clover* is primarily a pasture plant and should be included in pasture mixtures to improve the feeding value of the forage. It is a low-growing perennial, and produces rather shallow roots and prostrate stems. When moisture is abundant it produces heavy yields of forage, but during the drier seasons of the year remains in a more or less dormant condition, reviving as soon as moisture is supplied.

*Sweet Clover* is often considered a weed in many localities where it grows spontaneously. When handled properly, however, it is one of the most productive legumes for pasture purposes. There are two common varieties grown in Idaho, the white-flowered and the yellow-flowered, both of which are biennials. As the yellow-flowered variety grows closer to the ground, it is better suited to pasture mixtures and will generally reseed itself under average grazing conditions. The white-flowered variety can be used for hay as well as for pasture, but the hay is generally quite coarse and woody. The culture of sweet clover will be considered later.

*Alfalfa* is the most dependable legume for hay thruout the western United States. Where the soil and climatic conditions are favorable, it continues producing profitable yields for a number of years after seeding. It is a long-lived perennial with a heavy tap root which can secure moisture from the lower subsoil and it produces excellent yields and hay of a high quality. While it is primarily a hay plant, it can be used for pasture if properly handled. Alfalfa makes an excellent pasture for hogs, but cannot be pastured safely with cattle without some danger from bloating. Where it is desired for a cattle pasture some grasses should be seeded with it so that the cattle will not eat enough of the alfalfa at a time to be affected.

*Vetch* is an annual and of value in mixtures with wheat or rye for winter and spring pasture, silage, or for hay production. It is also



TYPICAL LEGUME SEEDS ENLARGED X 4.

1. Alfalfa 2. Sweet Clover 3. Alsike Clover 4. Medium Red Clover 5. Soy Bean  
6. White Clover 7. Hairy Vetch. (Original).



equally valuable for green manure. Vetch culture will be discussed later.

### GRASS MIXTURES

#### Cost of Seed Often Determines the Grass to Be Seeded.

The mixture to be seeded is often determined by the price of the seed, especially where two grasses are equally successful in a locality. In general, timothy and redtop seeds are the least expensive, because of the large acreage grown and the ease of harvesting the seed. Orchard, brome, and tall meadow-oat grasses are often quite high in price, because the yield of seed is less and much of the seed is imported. Kentucky bluegrass seed which has been expensive, is becoming cheaper because of perfected methods of harvesting and handling the crop. The climatic conditions thruout Idaho are favorable for the production of grass seed which is a means of reducing the cost of seeding meadows and pastures. In the case of legume seeds, alfalfa and red clover are generally quite cheap, while sweet clover and white clover are much higher in price. Because of the large quantity of red-clover and alsike-clover seed produced on the irrigated farms of Idaho, these should be somewhat cheaper if purchased directly from the farmer. As grass seed is generally quite expensive, success must be quite certain in order to encourage the planting of meadows and pastures where grain crops might be grown. Where the livestock industry is important, the need of an adequate supply of forage will often determine the acreage grown, regardless of the cost of seeding.

#### Suggested Mixtures.

Mixtures are preferable to a single grass unless grown primarily for seed. Since very little grass is grown primarily for seed in Idaho, a mixture is better suited to the average farm. A mixture of grasses usually produces better yields and a greater amount of aftermath for pasture than a single grass. The bunch and sod-forming grasses can be grown together, as may also those having deep roots with those of shallow-rooting habits. The legumes, when grown in combination with the grasses mentioned, increase the feeding value. The sod-forming grasses are needed particularly where a meadow is used for early spring and late fall or winter grazing to prevent the ground from being trampled so as to injure the growth of the grass. Most farmers desire a grass that can be cut for hay and the aftermath utilized for pasture. This can seldom be obtained where a single grass is seeded. While the most common grass mixture is timothy and red clover, experience has shown that this is not the best mixture that may be planted under all conditions. The yield is high where there is sufficient soil moisture, but where moisture is deficient, other grasses should be sown that will produce greater yields.

Most commercial seed houses advertise their "grass mixtures" for

special soil conditions. In many cases these mixtures may be satisfactory, but it is generally advisable to purchase the individual grasses desired and to mix them before seeding, as the mixture or quality of the "commercial mixture" may not be satisfactory. Poor seed is sometimes used in making up such mixtures so that the actual price is greater than the cost of pure seed of the grasses used which could be mixed to suit the condition desired.

In order to be safe in seeding grasses and small legumes, samples of the seed should be secured before purchasing and be sent to the State Seed Commissioner at Boise or to the Branch Seed Laboratory at Moscow for test. The purity analysis and germination, as determined, are not always indicative of the value of a lot of seed. One lot may show a purity of 99 per cent and contain a few noxious weeds, while another may show a purity of only 90 per cent and be free from noxious weeds, so that the second would be preferable for seeding.

It is very difficult to suggest grass mixtures for the non-irrigated areas of the state as they vary so much. Those named below are selected as suitable for growth under varying soil moisture or rainfall conditions. In some localities there may be sufficient rainfall, but the soil may not be retentive of moisture. In others, the soil may hold moisture, but the rainfall may be insufficient, so that more drouth-resistant grasses must be selected. The preparation of the seedbed and the time of seeding will likewise determine the types to choose, so that the selection should only be made after the conditions have been thoroly analyzed.

The following grass mixtures with the quantity of seed of each required for an acre, are suggested for different localities in the state:

I. Localities where the annual rainfall exceeds twenty-two inches and where the soil overflows or remains damp thruout the greater part of the season:

Hay:

- (1) Timothy 12 lbs., red clover 8 lbs.
- (2) Timothy 6 lbs., redbtop 6 lbs., alsike clover 4 lbs.
- (3) Orchard 10 lbs., timothy 5 lbs., redbtop 3 lbs., red clover 4 lbs., alfalfa 2 lbs., alsike clover 1 lb.

Pasture:

- (1) Kentucky blue 8 lbs., orchard 6 lbs., white clover 4 lbs.
- (2) Kentucky blue 5 lbs., redbtop 6 lbs., alsike and white clover 4 lbs.

II. Localities where the annual rainfall varies from fifteen to twenty-one inches, and where the soil is fairly retentive of moisture.

Hay:

- (1) Perennial rye 2 lbs., tall oat 2 lbs., orchard 3 lbs., timothy

3 lbs., brome 3 lbs., alfalfa 2 lbs., alsike 2 lbs., red clover 2 lbs.

(2) Timothy 2 lbs., orchard 8 lbs., alfalfa 2 lbs., brome 3 lbs., red clover 3 lbs.

Pasture:

(1) Brome 10 lbs., alfalfa and sweet clover mixed 6 lbs.

(2) Brome 8 lbs., orchard 8 lbs., red clover 6 lbs.

(3) Brome 5 lbs., orchard 5 lbs., perennial rye 3 lbs., alfalfa 2 lbs., sweet clover 2 lbs.

III. Localities where the annual rainfall is less than fifteen inches and where the soil dries out during the growing season:

Hay:

(1) Orchard 5 lbs., tall oat 8 lbs., alfalfa 4 lbs.

(2) Brome 10 lbs., alfalfa 5 lbs.

Pasture:

(1) Brome 10 lbs., alfalfa 4 lbs., sweet clover 4 lbs.

(2) Sweet clover 15 lbs.

(3) Brome 15 lbs.

#### PREPARATION OF THE SEEDBED

The method of preparing the seedbed depends largely on the time of seeding and the previous crop. A good seedbed is more essential for success with grasses than with corn, peas, or small grains. The soil should be free from weeds, should be retentive of moisture, well supplied with available plant food, and well compacted. Since a well compacted seedbed is necessary spring plowing is not suitable preparation for spring planting. In such instances, fall plowing will place the soil in excellent condition and make it possible to work the soil earlier in the spring, because it will dry out sooner than ground that has not been plowed. Corn, potato, or pea stubble can be worked into condition for spring planting by clearing the crop residue and thoroly disking until the seedbed is in good condition. On the heavier types of soil, spring plowing may be beneficial, but it should not be deeper than four inches, as the ground cannot be firmly compacted where deep plowing is practiced.

In the dry lands of Idaho, the grass crop should follow the small grain crop in the rotation. The stubble should be disked as soon as possible after harvest to conserve moisture and help sprout the weeds and volunteer grain. The field should then be plowed before winter, as deep as possible, but at least eight inches. The light soils of the cut-over lands can be prepared better by disking than plowing, because they are difficult to compact and deep plowing prevents the preparation of a firm seedbed. All ground should be disked as early as possible in the spring, then harrowed and rolled or packed. The use of a land roller,

or subsurface packer is necessary where the ground is very loose. As all grass seeds are quite small and do not carry a large amount of reserve food for the young plants, it is necessary to seed shallow in order that the plants may quickly push thru the soil to the surface. If the seedbed is very loose the moisture cannot be carried up to the seed from the subsoil, which causes delayed germination or an imperfect stand.

*Legumes need lime.* Red clover, alfalfa, and sweet clover need a good supply of lime, if success is to be assured. Although most of the soils throughout the state are supplied with lime, some are quite deficient. Under average conditions, the addition of one-half ton of burnt lime or one ton of ground limestone will correct this acidity. Often land which has been poorly drained and marshy will show an acid reaction when tested. In this case lime should be applied either before the ground is plowed, or before the fall-plowed ground has been worked into a compact seedbed in the spring. The subsequent harrowing will work the lime into the soil where it will become available for the young plants as soon as seeded.

Drainage is likewise important as these legumes, with the possible exception of alsike clover, cannot grow in soils where the water level is close to the surface. Such soils should first be drained and then limed. If a small sample of soil is taken from the surface at various points in the field and sent to the Agricultural Experiment Station at Moscow, it will be tested for acidity. This will be necessary in exceptional instances only, as the dry-land soils as a whole are not acid.

*Inoculation is also necessary for legumes.* Soils which have not grown the particular legume to be seeded must be inoculated before it is likely to succeed. If that legume has grown on the land as a weed, as the sweet clover often does, inoculation will probably be unnecessary. Land which has grown sweet clover will not need inoculation for growing alfalfa and vice versa, because the same strain of bacteria lives on the roots of each of these plants. The pure-culture method of inoculating the seed should be used, as there is less chance of failure if properly carried out. It is cheaper than the soil-transfer method and there is no danger of introducing weed pests, as in the latter case. While pure cultures of bacteria may be purchased from firms preparing them on a commercial scale, the initial cost is greater in proportion to the value of the materials than that of the same cultures obtained from your experiment station at cost. Orders for these cultures should be sent to the Department of Bacteriology, University of Idaho, at Moscow, a few weeks in advance of planting time, stating the kind of legume to be seeded, and the acreage. This inoculating material will cost twenty-five cents an acre, postage prepaid, and full directions for treatment accompany each culture so that inoculation should be successful.

### TIME OF SEEDING

As a rule, spring seeding is more successful in the drier portions of the state. The greater part of the rainfall occurs during the winter, so that conditions are ideal for spring seeding. By plowing in the fall and leaving the soil rough during the winter, this moisture is stored in the soil and can be utilized the following season by the grass plants. Winter rains aid in compacting the seedbed. Early seeding is essential for grasses and the smaller seeded legumes, such as red and alsike clover. The seedbed can be prepared earlier in the spring where fall plowing is practiced and at the same time be given better preparation with less expense.

### METHOD OF SEEDING

Few farmers are supplied with special grass drills, but many grain drills are provided with grass-seeding attachments. Drills operate better where grasses of the same size and weight of seed are used than where an assortment of seeds is planted. The large light seeds, such as those of brome and tall meadow oat grasses are often difficult to seed with a drill unless a special force-feed is used. Very good stands can be secured with the use of the "fiddle" seeder, wheelbarrow seeder, or by broadcast seeding. If any of these last methods is used, the ground should be dragged with a harrow or brush drag, to cover the seed. After harrowing the seed in, a roller should be used to help cover the seeds and pack the soil around them, thus improving the conditions for germination.

### THE "NURSE CROP"

A nurse crop should not be used, except under the most favorable conditions. Moisture is generally the limiting factor for success in securing a stand of grass and the nurse crop uses the moisture that should be supplied to the grass. If a nurse crop of small grain is used, the rate of seeding should be reduced from one-fourth to one-half the normal rate used for grain. Many times a nurse crop will cause a failure to secure a stand of the grass which, to the live-stock farmer, would represent a greater loss than the profit secured from the sale of the products from the nurse crop. If the seedbed is well prepared and the grass is seeded early, a large amount of grazing or a fair cutting of hay will be furnished before the close of the season, so that the use of the ground is not an entire loss for the season. However, a nurse crop will often keep weeds in control and prevent injury from soil blowing, but if the season turns out unfavorable, the nurse crop should be harvested for hay. Small grains are generally used as nurse crops, as their cash return is relatively high. Many farmers who are growing field peas as a cash

crop, find them more desirable as a nurse crop than wheat, oats, or barley. It is important that a pea variety be chosen for the nurse crop that does not produce too heavy a growth of vines. A rank-growing pea removes a greater amount of moisture from the soil and shades the ground too much for the grass crop to succeed.

### YIELDS OF HAY

Table I gives the acre yield of hay secured from grass mixtures seeded on Palouse silt loam soil at the University Farm at Moscow, where the normal rainfall is 20.22 inches a year. The figures following the grass represent the number of pounds of seed planted to the acre.

**TABLE I.**  
**Yields of Grass Mixtures, 1916-1917.**

Grass Mixture Seeded in Spring of 1915	Yield in Pounds to the Acre					Average
	1916		1917		Average	
	1st cutting	2nd cutting	1st cutting	2nd cutting		
	lbs.	lbs.	lbs.	lbs.	lbs.	tons
Timothy (12) alfalfa (10).....	3360	1470	5200	2000	6015	3.01
Orchard (8) timothy (6)						
red clover (4).....	4200	.....	6000	.....	5100	2.55
Orchard (10) timothy (5)						
redtop (3) red clover (4)						
alfalfa (2) alsike (1).....	2520	.....	7200	2400	6060	3.03
Timothy (12) .....	2520	.....	3600	.....	3060	1.53
Perennial rye (2) tall oat (2)						
orchard (3) timothy (3)						
brome (3) alfalfa (2)						
alsike (2) red clover (2).....	3360	.....	6400	600	5180	2.59
Brome (8) orchard (12) red						
clover (6) .....	5600	1300	6400	.....	6650	3.33
Brome (15).....	5800	.....	5000	.....	5400	2.70
Timothy (12) red clover (8)	5600	1200	2600	.....	4700	2.35
Timothy (12) red clover (8)						
alfalfa (2) brome (3) red						
clover (3).....	4600	1400	4600	400	5500	2.75
Brome (15) alfalfa (6).....	5100	1600	5800	400	6450	3.23
Grimm alfalfa (6).....	3800	2800	5200	800	6300	3.15

### SWEET CLOVER A VALUABLE FORAGE CROP

Sweet clover is one of the most valuable legumes for the drier parts of Idaho. It makes very little growth above ground during the early part of the first season, because during that time it is developing a deep tap root which will later be of benefit in withstanding drouth. If conditions are favorable, the leafy growth may reach a height of 30 inches or more by the close of the first season, producing a good yield of hay. Such growth would furnish a large amount of pasturage from the middle to the close of the season. Growth starts very early the second season, in fact, earlier than most other legumes. It is very rapid and the plants often reach a height of 6 to 10 feet before maturity. As rel-

atively few leaves are retained and the stems are quite woody and coarse, this vegetation is undesirable for hay. If harvested for hay the crop should be cut before the plants reach a height of 30 inches. In order to produce a second crop, a stubble of at least 5 inches must be left, as sweet clover starts from buds on the old stems instead of from the crown as in the case of alfalfa. The second season's crop is more valuable for pasture than for hay and will support more animals to a given acreage than will the cultivated grasses. It is asserted that sweet clover is not relished by animals and will cause bloating. The first objection can be overcome by turning the stock into the clover very soon after growth starts in the spring. After once becoming accustomed to it, stock generally prefer it to other forage. When allowed free range of sweet clover day and night there is little danger from bloating. If the animals fill on dry forage before going in to the fields while the dew is on, they will usually not eat enough at one time to be dangerous to them. Experience of stockmen over the United States has proven that there are fewer animals lost from grazing sweet clover than from grazing alfalfa.

*Culture.* Sweet clover requires as good a seedbed as the tame grasses or alfalfa. It is generally thought that it is not difficult to secure a stand because the crop grows so readily in waste places around the farm. But experience has shown that it is as exacting in its requirements as alfalfa. Good seed is essential to success. A poor stand of sweet clover is often due to planting seed having poor germination. Unhulled seed and hulled seed that has not been treated, usually germinates poorly, due to many of the seeds having hard-seed-coats which will not absorb water to start germination. If unhulled seed is used, it must be seeded at a heavier rate than seed which has been treated. Treated or "scarified" seed can be purchased on the market. The seed coat is scratched by this process so that the seed will absorb water and hasten germination. Scarified seed is generally sold at a higher price than unhulled or untreated seed, but the increase in germination is usually sufficient to offset this increased price. Early seeding must be practiced in order that the plant may be well developed before the dry season occurs, as the plants will then be able to withstand this condition.

Table II gives the yield of the white and yellow biennial sweet clover seeded at the University Farm at Moscow in the spring of 1916.

**TABLE II.**  
**Yields of Sweet Clover, 1916-1917.**

Variety	Time of Seeding	Rate of Seeding to the acre	Yield of hay to the Acre			
			1916	1917	Ave.	
		lbs.	lbs.	lbs.	lbs.	tons
White Flowered Early.....		20	7500	9100	8300	4.15
White Flowered Medium.....		20	3500	8800	6150	3.08
Yellow Flowered Early.....		12	3500	6800	5150	2.58

While the yield of the yellow-flowered variety was lower, it was due in part to a thinner stand resulting from the lighter rate of seeding. The

quality of hay produced by the yellow-flowered variety was much better than from the white, as the stems are not so coarse and woody.

### ALFALFA

While the common alfalfa can be grown in those localities where the season is mild, in general, the hardy varieties are to be preferred. A number of strains of variegated alfalfa have been introduced into the United State from Europe, where they were grown under the name of sand lucern. One of these, the "Grimm," was introduced into Minnesota from Germany in 1857. It is hardy and able to withstand the conditions thruout the drier regions of Idaho. Grimm alfalfa will often withstand late spring frosts where the common variety will be so badly injured as to necessitate early cutting to save the crop. Comparisons in yield of Grimm and common dry-land alfalfa (common alfalfa seed grown under dry-land conditions) at the University Farm are shown for the years of 1915-1917 inclusive in Table III.

**TABLE III.**  
**Comparative Yield of Grimm and Common Alfalfa.**

Variety	Acre Yield of Dry Hay (a)								
	1915		1916		1917			Ave. Yield.	
	Total	1st Cutting	2nd Cutting	Total	1st Cutting	2nd Cutting	Total	lbs.	tons
Grimm .....	1520	3340	1800	5140	5700	1000	6700	4453	2.22
Common Dry-Land	1000	2400	1600	4000	4800	1500	6300	3767	1.88

(a) Seeded in spring of 1915.

*Culture.* The seed-bed should be prepared in the same manner for alfalfa as for the tame grasses. It is equally important that the seed-bed be fall-plowed to absorb the winter rainfall, and that it be well compacted so that the soil moisture may be held available for an even and rapid germination of the seeds. Alfalfa produces best where there is an abundant supply of lime present in the soil. The soil must be inoculated with the proper kind of bacteria before maximum results can be expected. Methods of liming and inoculation have been discussed above. The method of seeding is governed largely by the condition of soil moisture and the amount and distribution of the rainfall. Table IV gives the hay yields of Grimm alfalfa, seeded in 1915 at the University Farm, drilled at varying rates.



**TABLE IV.**  
**Relation of Rate of Seeding to Yield of Grimm Alfalfa.**

Rate of Seeding		Acre Yield of Dry Hay.							
		1915		1916			1917		Average
Seeded in Spring 1915	Total	1st cutting	2nd cutting	Total	1st cutting	2nd cutting	Total	1915-'16-'17	'16-'17
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
6	1340	3800	2800	6600	5200	800	6000	4647	6300
8	1500	2640	1700	4340	5500	1000	6500	4113	5420
10	1520	3340	1800	5140	5700	1000	6700	4453	5920
12	1615	3160	1800	4960	5400	1000	6400	4325	5680

The highest yield secured the first season was from the plot seeded at the heaviest rate. There were more plants and stems produced to a unit of area where the rate of seeding was increased. After the first season the yield is not affected so much by the rate of planting as by the relative stand or number of plants to the acre. If a satisfactory stand can be secured by seeding 6 pounds, a heavier rate of seeding will not produce a greater average yield. The competition between plants for the soil moisture will reduce the stand until all areas have about the same number of plants. Where there are few plants, each plant will produce a greater number of stems and leaves which tends to offset the scarcity of individual plants. The method of planting alfalfa depends on the soil conditions, the amount of rainfall in the locality, and the use of the crop, as shown in Table V.

**TABLE V.**  
**Relation of Method of Seeding to Yield of Grimm Alfalfa.**

Method of Seeding		Acre Yield of Dry Hay.							
		1916			1917			Average	
Seeded spring 1915	Rate per acre	1st cutting	2nd cutting	Total	1st cutting	2nd cutting	Total	lbs.	tons
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	tons
36-in. rows.....	1-2	2940	1225	4165	2100	2100	4200	4182	2.09
24-in. rows.....	2-3	2877	1040	3917	3986	3294	7280	5598	2.80
Drill .....	6	3800	2800	6600	5200	800	6000	6300	3.15
Drill .....	8	2640	1700	4340	5500	1000	6500	5420	2.71

Row planting is not advisable where the annual rainfall is greater than 18 inches, except in the lighter gravelly soils on the cut-over lands. Where drilling is practiced, cultivation cannot be used and is not needed, as the plants will control the weeds if the seed-bed is properly prepared and the crop is seeded at the right time. In the drier areas, or on soils which dry out early in the season, row planting will produce the best hay yields since cultivation will control the weeds so that the individual plants will have a greater supply of moisture. The spacing of the rows will depend largely on the amount of rainfall. Where the rainfall is from 15 to 18 inches annually, the 20 or 24-inch spacing is to be pre-

ferred to a wider spacing of rows. In seeding under non-irrigated conditions, the bottom lands and deeper bench soils should be chosen because of their greater supply of moisture during drouthy periods.

#### Harvesting and Curing.

The time of harvesting alfalfa will depend largely on the utilization of the crop. For feeding horses, the hay should be well matured, while for feeding cattle, sheep and hogs, it may be cut somewhat earlier. Weather conditions in Idaho are generally favorable so that the crop can be harvested when in proper condition. The longer the crop remains after it has reached the tenth bloom (i. e., when about one-tenth of the flowers are in bloom), the coarser the quality of hay and the greater the percentage of leaves lost. The stage of the bloom is generally used to denote the time to cut, altho the growth of the new shoots from the crown is sometimes used. If the season happens to be very wet, or the plants are grown on land that is poorly drained, they will generally be late in producing flowers. In that case, the crop should be harvested before the new shoots have reached such a height as to be cut by the machine, as the growth of the following crop will be checked if this occurs. Alfalfa should be raked into a loose windrow soon after cutting and allowed to cure slowly. This will prevent an excessive loss of leaves by shattering and the hay will retain a better color.

#### VETCHES

There are two common types of vetch that can be grown in Idaho, the hairy, or winter vetch, and the common, or spring vetch. Both are slender, climbing legumes with tendrils similar to those of the field pea. The hairy vetch produces a rank growth under favorable conditions. While it is normally an annual plant, it sometimes acts as a biennial under favorable conditions. The plants are covered with a growth of fine white hairs; the leaves developing a large number of leaflets as compared with the common vetch. The pods are dull in color with from two to eight small black seeds in each pod.

The common vetch does not grow so rank and tall as the hairy vetch and unlike it, the stems are smooth with fewer leaflets to each leaf. The pods of the common vetch are brownish in color and contain from four to five seeds which vary from grayish to mottled in color.

*Culture.* The hairy vetch may be planted with winter wheat or rye to be utilized for pasture, hay, silage, or green manure. The small grain acts as a support for the stems of the vetch which are very weak. If the vetch is seeded alone for pasture or seed, the rate of seeding should be from 40 to 50 pounds to the acre in order that the plants may aid in supporting each other. When seeded with a small grain, the normal rate of seeding the grain may be used and the vetch seeded at the rate of 25 lbs. or more to the acre, depending on the use to which the crop is to be put. Red Russian wheat is suitable in a mixture with winter vetch for silage, as it produces a heavy growth and matures at the same time as the vetch. If the field has not grown vetch, it is necessary to inoculate, as the success of the crop is largely dependent on this factor. Winter vetch should be seeded at the same time as winter-

sown grains, in a given locality. While winter vetch may be seeded as a spring annual, the best results are to be secured from fall seeding, if the soil is sufficiently moist to start growth properly. The common or spring vetch is seeded in the same manner as winter vetch. It seldom produces sufficient yields to be profitable. In many places it will not mature seed when sown in the spring. Wherever field peas can be grown as a spring-sown crop, they are to be preferred to spring vetch on account of their greater commercial value and ease of handling.

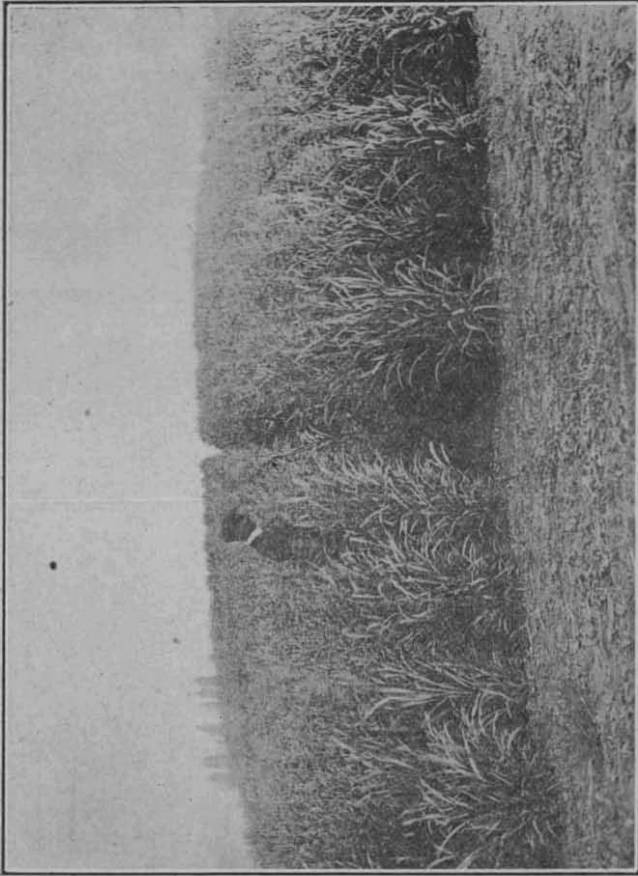
All vetch has a great disadvantage in the case of shattering of the seed from the pod upon ripening. If the crop is grown for seed, it will often volunteer in the field for a number of years. For this reason, vetch is a better crop for pasture, hay, or green manure, as this disadvantage can then be overcome. There is some danger of stock bloating when pastured on vetch, so that they should not be turned into the fields when the crop is wet. When vetch is grown with rye or winter wheat for hay, it can be pastured during the early part of the season without reducing the yield of hay to any extent. For the best quality of hay, vetch should be cut when the pods are well formed, but before they start to fill. It is harvested and cured in about the same manner as pea and oat hay.

#### SUDAN GRASS

Sudan grass is relatively a new crop in Idaho. It has been grown in the United States since 1909, but only the past few years over an extensive area. Sudan is an annual grass closely related to the sorghums and Johnson grass. In appearance it is similar to Johnson grass, but is an annual, while the Johnson grass is a perennial. Sudan produces stems varying from one-fourth to one-half inch in diameter and the leaves are quite similar to those of the sweet sorghum or "cane". The plant stools at the crown and produces a large number of stems. The seed is produced in a large open panicle very much like common oats.

While very few of the sorghums can be grown successfully in Idaho on account of the cool and short growing season, Sudan grass seems to be less restricted as to growing conditions. It can be grown with success at elevations below 3000 feet and will produce a good crop of seed. If the air drainage is good, it can be grown as a hay crop at higher elevations. Sudan has many advantages over the millets as a pasture, hay, and seed crop. It produces heavier yields of forage and hay and the hay is more valuable for feeding purposes. The plants make a rank growth, but the stems are slender and palatable. Growth is quite rapid at lower elevations, and if conditions are favorable, two cuttings of hay and some pasturage may be secured during the season. When grown for seed production, the number of cuttings is reduced. The yield of seed will vary from 200 to 1000 pounds per acre.

The seedbed should be well prepared for best results, but Sudan will succeed on a poor seedbed where the perennial tame grasses would fail. The seed should not be planted until the soil is warm; in general, about a week after danger of frost is passed. It may be planted later in the season, but the yield and number of cuttings will be reduced. The method and rate of seeding depends on the use to which the crop is to be put. When grown for pasture, it should generally be broadcasted or drilled.



SUDAN GRASS SEEDED IN ROWS AT UNIVERSITY FARM, SEASON OF 1919

If the rainfall in the locality is very light, and the soil dry, row plantings are even better for pasture purposes. In drilling, from 15 to 25 pounds are seeded to the acre; the heavier rate where the rainfall is greater. If the crop is desired for hay or seed production, it should be seeded in rows. The rows may be spaced from 18 inches to 36 inches apart, the closer spacings used where weeds are likely to be bad. A grain drill may be used for row plantings, stopping up certain holes in the drill to space the rows properly. The drill should be adjusted to seed about 5 pounds of seed to the acre if the rows are 18 inches apart, or about 3 pounds to the acre if they are 36 inches apart.

With row plantings, the crop should be cultivated at least once and often two cultivations should be given. After the crop starts a vigorous growth, the plants will soon shade the ground so that weeds cannot grow. Sudan seeded at the University Farm on June 6, 1919, produced a profitable yield of hay. The season was quite late and the nights were cold thruout the season. One series of plots was harvested on August 14th and a second cutting was secured on September 19, after the first killing frost of September 13.

Table VI gives the yield in pounds to the acre of Sudan, seeding at varying rates and methods for the season 1919.

TABLE VI.

Relation of Rate and Method of Seeding Sudan Grass to Yield of Dry Hay, Season, 1919.

Method of Seeding	Rate of Seeding	Yield 1st Cutting	Yield 2nd cutting	Total Yield
	lbs.	lbs.	lbs.	lbs.
Broadcast .....	10	1432	1736	3168
Broadcast .....	20	1652	1740	3392
Broadcast .....	30	2765	2504	5269
18-inch rows.....	6	2640	1856	4496
30-inch rows.....	3	2046	2150	4196

The results given in Table VI show the possibility of securing a fair yield of hay and of utilizing the second growth for pasture. In harvesting for hay, the crop should be cut at the full-bloom stage or later, as the feeding value is higher at the later stages of growth. For seed production, it should be cut when the first seed is in the hard dough stage but before the seed begins to shatter. It is advisable to use a binder in harvesting for seed production, as it reduces the amount of handling needed and the quantity of seed shattered. The bundles may be topped as soon as thoroly cured and only the heads threshed. The stover is of value for feeding cattle and horses.

### SOY BEANS

The soy bean is a native of the Orient and is a valuable plant for seed and hay production. The plant produces a bushy or semi-vine growth; the leaves are broad and covered with fine hairs, unlike the common

navy and garden bean. Flowers are produced quite close to the main stem and are very small while the seed is borne in a hairy pod, each usually containing three seeds. The seeds contain a high percentage of protein and oil and can be utilized for stock feed, human food, and in manufacturing.

There are very few varieties of soy beans that will mature seed in Idaho, because of the short growing season. At elevations below 3000 feet, very early varieties will generally mature. In many places the crop can be grown for hay if the season is too short for seed production. The Ogemaw, a dark brown-seeded variety first grown in Michigan, has matured seed at the University Farm each of the past three seasons.

The culture of soy beans is similar to that of the navy bean. The seed should be inoculated with the proper strain of bacteria before seeding. As the young plants are quite susceptible to frost the seed should not be planted until all danger of frost is past. For hay or seed production on non-irrigated lands, row planting is probably best. The seed may be sown with a grain drill, in which case the drill holes should be stopped up so as to space the rows about 30 inches apart. The seed should be spaced about 2 inches apart in the row which rate of planting will require from 20 to 35 pounds to the acre.

Yields of one and one-half to two tons of hay can be secured on soils well supplied with moisture. Soy beans will probably not produce sufficient growth to warrant their use on cut-over lands, as these soils are generally too light and dry. Soy bean hay should be harvested with a mower and cured in small cocks to prevent too rapid drying of the leaves.

### SUMMARY

In Idaho forage crops are second in importance only to cereals. While many grasses and legumes may be grown on non-irrigated lands, their success is largely determined by the cultural practices used in preparing the seed-bed and in seeding. Grasses sometimes succeed when sown with a nurse crop, but the nurse crop may be the cause of failure to secure a perfect stand. Harvesting the nurse crop for hay will aid in overcoming this disadvantage.

Sweet clover promises to be an important legume for dry lands and for alkali soils, usually succeeding where red clover cannot be grown. Grimm alfalfa produces heavier yields and is more hardy than common dry-land alfalfa. Good hay yields of alfalfa can be secured by drilling the seed in the more humid areas, but row seeding is necessary under dry-land conditions.

Winter, or hairy vetch can be grown on non-irrigated lands for hay, silage, or pasture, but should not be grown for seed as it shatters and will volunteer for many years. Sudan grass is a promising annual crop for pasture and hay at elevations below 3000 feet. It should not be seeded until danger of frost is passed. Soy beans are successful only in limited areas, as the season in Idaho is generally too short for their best development.

