COOPERATIVE EXTENSION UNIVERSITY OF CALIFORNIA

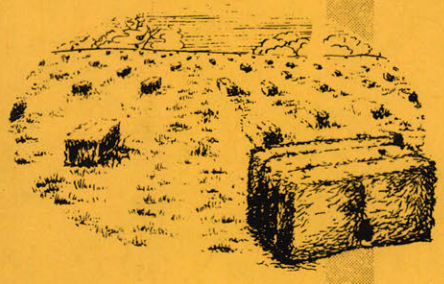
Agronomy Notes

for farm advisors working with field, forage, oil, range and seed crops

September/October 1975









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MICROENVIRONMENT STUDIES AT THE SIERRA FIELD STATION RELATED TO RANGE IMPROVEMENT

Editor's Note: The following is taken from "Microenvironment of a Dynamic Annual Community in Relation to Range Improvement", R. A. Evans, B. L. Kay and J. A. Young; HILGARDIA, Vol. 23, No. 3, March 1975. Single copies are available from Publications, Division of Agricultural Sciences, University of California, 1422 S. Tenth Street, Richmond, CA 94804. This data re-enforces knowledge of winter climates on annual range forage growth. It also shows that ambient air temperatures are a reasonable estimate of soil temperatures for the purpose of evaluating management alternatives.

INTERRELATIONS AMONG ENVIRONMENTAL FACTORS AND PLANT RESPONSES

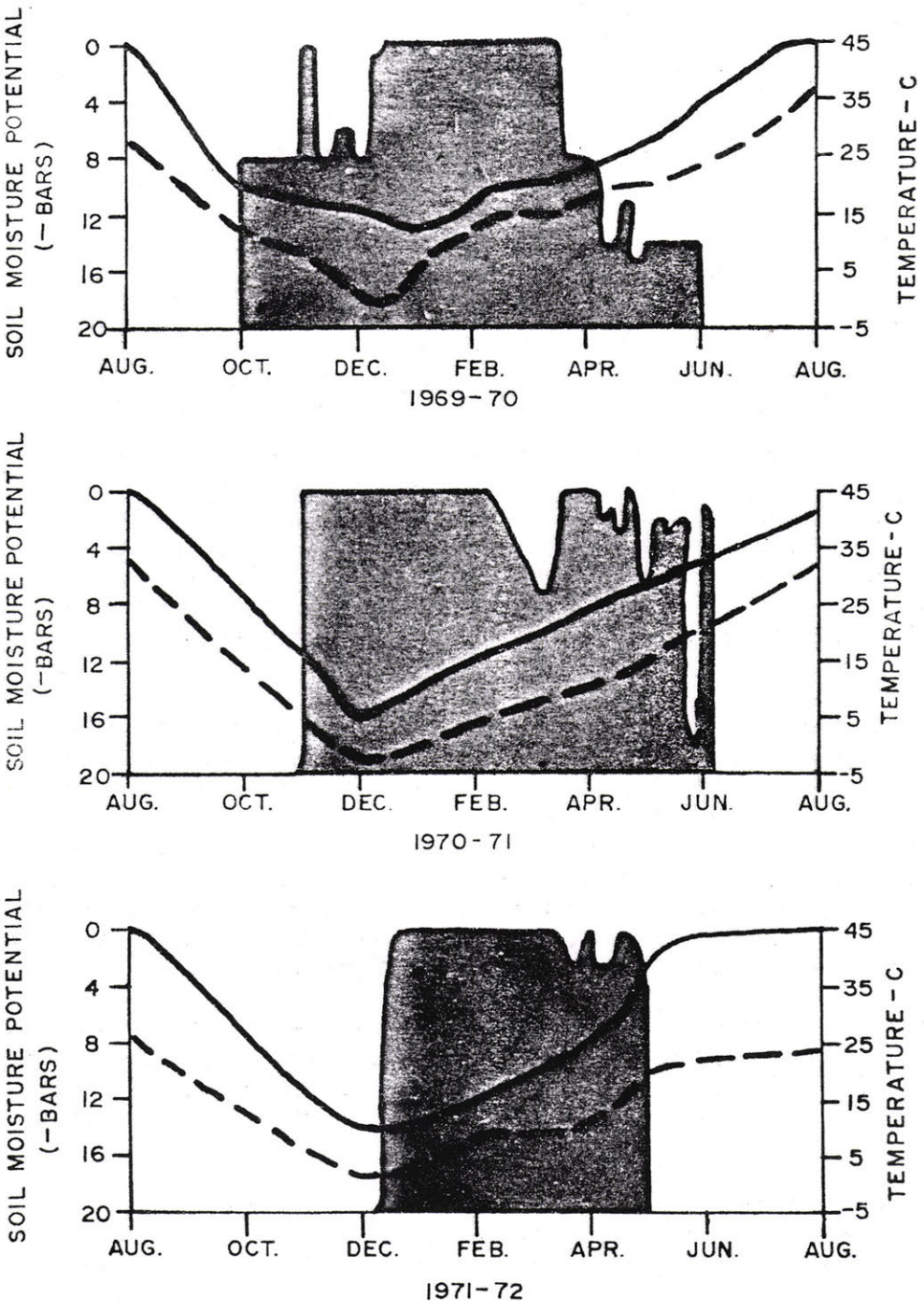
Available soil moisture permitted seed germination, emergence, and plant growth in this annual rangeland community. Temperature controlled the general rate of plant growth and created detectable differences in terms of plant responses, when it dropped low enough to prevent, or markedly reduce, seed or caryopsis germination or to retard seedling growth. Temperature also affected plant growth when it rose high enough to bring about quicker drying of plants, either directly or indirectly, by causing more rapid depletion of soil moisture.

An inverse relation between favorable temperature and available moisture (typical of the Mediterranean-like climate) was shown in the seasonal trends of the 3 years of the study (fig. 12). This relation is expressed here in more meaningful measurements for growing plants than is usual, however. Instead of temperatures recorded away from the plant environment, these were measured at the growing levels in soil and air very close to the plants. Moisture is usually recorded in terms of precipitation, taken either near to or relatively far from the site. The available moisture given here is in terms of water potential in the root zone of the plants.

The time of coincidence of favorable temperature and available moisture for active plant growth varied quite markedly among years, as did the length of uninterrupted available soil moisture. These variations were reflected in total plant growth, density, and botanical composition in specific years of the study.

When seasonal trends in light intensity are superimposed on trends of temperature and moisture, especially those altered by plant growth, limiting factors affecting plant growth throughout the period form a comprehensive mosaic.

Through the characterization of the microenvironment and its alteration by weed control and the responses of plants to these conditions, it is possible to characterize more clearly the dynamics of the community. It is also possible to define differences of aspect in terms of both microenvironment and plant responses. This approach develops concepts and relations not reported before. Among these, light is (in terms of plant competition) the overriding factor that prevented establishment of perennial grasses in this community. Soil-moisture depletion by adjacent plants through the growing season was of little or no effect except in isolated instances in midseason when soil moisture was rapidly depleted. Further, the shading effect of the canopy of annual plants is vertically restricted to 1 or 2 cm above the soil surface during crucial periods of emergence and growth of the seeded species.



Duration of soil moisture (shaded area) and general trends of day (solid line) and night (dashed line) air temperatures measured close to plants in an annual rangeland community in (A) 1969-70, (B) 1970-71, and (C) 1971-72. (Figure 12)

Light intensity at 3 to 6 cm approximated that of full illumination during this period. Even during midwinter, when illumination is lowest, there were days of considerable light intensity (with much variability between days), when there was no shading effect of a closed canopy of annual plants. With a closed canopy, in contrast, light intensity through this entire period remained very low. The seeded annual clovers were not as vulnerable to these low light levels as were the *Phalaris* species. Rose clover was, apparently, more tolerant of shade competition than was subclover.

Microenvironmental data, besides furthering understanding of complex phenomena of the ecosystem, establish benchmark or standard regimes of temperature, light, and soil moisture for laboratory experiments of seed germination, seedling growth, and other plant responses. These studies, in turn, answer questions about the dynamics of plant communities.

-WJC-

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CORRECTION: Page 22, July/August 1975, Agronomy Notes

DESCRIPTIVE TERMS AND DEFINITIONS FOR INSECT AND DISEASE RESISTANCE

An oversight occurred in the definition of terms that needs correction. The committee defining the three classifications of resistance, tolerant, and susceptible, wish to use the word "resistance" and not the word "resistant" as was reported in the above article. Please make that correction.

-VLM-

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PROGRESS REPORT - ALFALFA SEED HARVESTING EFFICIENCY

Dr. John Goss, Agricultural Engineering Department, University of California, Davis, is in the process of observing and measuring the efficiency of harvesters in the seed crop. During these tests we also have compared the seed losses attributed to harvesting in the direction of lodged plants. This means we have compared losses traveling from south to north versus those obtained traveling from north to south with the harvester. The results of those tests are as follows:

Approximately 24 lbs. of seed per acre were lost when traveling from north to south. Very little seed was lost when traveling from south to north. These results again emphasize the value of harvesting in one direction going against the lodged plots (traveling south to north). The costs of dead heading one direction can easily be gained with the increased harvest efficiency.

Losses at the cutter bar were compared with and without vertical cutter bars in a very light stand. The mean clean seed loss per acre with seven 30" rows per pass was 2.8 lbs. with vertical cutter bar and 4.4 lbs. without the vertical cutter bar. This is a difference in favor of using the vertical cut-

ter bar of 1.6 lbs. The field where this test was conducted had a very light amount of plant material. I expect that the savings would be much greater in fields having dense foliage or even with average foliage growth.

These results would indicate that it would pay to install vertical cutter bars on the "in board" side of the harvester header.

W. Robert Sheesley, Farm Advisor
"Seed Crop Notes", Fresno County
September 8, 1975

-VLM-

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EFFECT OF APPLIED NITROGEN ON NODULATION AND EARLY GROWTH OF SOYBEANS

J. L. Hatfield et al.

Several workers have implied that young soybeans require an additional source of N until N fixation begins. Workers have reported that young soybeans became N-deficient when the nodule number was small and the soil was low in N. Earlier workers have stated that nodules grew only where a sufficient supply of carbohydrates was present to allow at least moderate root growth. Later investigations showed that the magnitude of N fixation was related to the level N in the root environment.

Apparently significant amounts of N fixation by the developing nodules have not been observed in soybeans until the initial bloom stage. Such a time lag in development of the nodules for N fixation can result in reduced plant growth and may be responsible for limiting the maximum potential yield of soybeans. This study was designed to determine the effect of N on the early nodulation and growth of soybeans.

'Cutler' soybeans (*Glycine max* (L.) Merr.) were grown for 6 weeks after emergence in a gravel culture system to evaluate the effects of applied N on nodulation and early growth. Treatments included inoculated plants supplied 10 meq/liter NO_3- for 0, 2, 4, and 6 weeks from the time of emergence and uninoculated plants supplied N for 6 weeks. Dry weight of inoculated plants receiving N for 0 and 2 weeks was significantly lower than that of inoculated plants receiving N for 4 and 6 weeks. Dry Weight of the stems and leaves was the same for the uninoculated plants receiving N for 6 weeks as for the inoculated plants receiving N for 4 or 6 weeks. The number of nodules was increased by the addition of N for 2 weeks following seedling emergence. Total N in the stem and leaves was the same for the inoculated plants supplied N for 4 and 6 weeks as for the uninoculated plants with N. These results provide evidence of the importance of soil N for the initial growth of soybeans, even in the presence of adequate inoculation.

Summary

Plants that had to depend entirely on their nodules for their N supply exhibited reduced dry weight accumulation after 6 weeks of growth. Supplying N for 4 weeks resulted in maximum dry weight accumulation, and the nodule development was similar to that shown by plants receiving no N in the nutrient

solution. Nodule development was greatest on plants receiving N for 2 weeks. Reduced nodule development on plants receiving no additional N was possibly a result of inadequate carbohydrate supplies, while the available N in the 4 and 6-week treatments possibly reduced the nodulation. These data suggest the importance of soil N on the initial growth of soybeans, even in the presence of adequate inoculation.

Agronomy Journal 66:112-114.
January-February 1975.

-VLM-

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ANHYDROUS AMMONIA AND PROPIONIC ACID AS HAY PRESERVATIVES

W. R. Knapp, T. A. Holt, and V. L. Lechtenberg

This study comes from Purdue University and involves the application of anhydrous ammonia and propionic acid to second cutting alfalfa, that has been dried for 24 hours. The material was baled at 32.4% moisture, twine-tied, with bales averaging 25 kilograms or 55 pounds. Six bales were assigned to each treatment.

Propionic acid was added at rates of 0.02, 0.2, 0.5, and 1.0 percent of the weight of the bales, and anhydrous ammonia was added at 1 percent. The six-bale stacks were covered with polyethylene before the ammonia treatment and after other treatments. Anhydrous ammonia was introduced as a gas through a hose placed between lower bales. Propionic acid was added in a water solution at a rate of 1 liter of water per bale. The solution was poured as evenly as possible on the cut edge of each bale so it penetrated well into the hay. Untreated bales received 1 liter of water per bale also. The additional water brought the moisture content of the propionic acid-treated and the control bales to 34.4%. Bales were allowed to set for a two-month storage period and then again weighed and final samples taken.

In hay baled at moisture levels better than 20% there is often heating brought on by metabolic activity of micro-organisms. Increase in microbial activity and heating result in loss of dry matter, sugars, fats and hemicellulose. The high temperature of poorly cured hay favors the maillard or browning reaction in which hexoses and amino acids react to form undigestible compounds.

Results

After two months of storage, ammonia-treated hay was green and apparently free of mold. The 1 percent propionic acid treatment appeared to be free of mold but had lost its green color. All other treatments and the controls were visibly molded and deteriorated.

Table 1 summarizes temperatures, dry matter losses, and digestibility.

The high temperatures reached in some treatments indicate high levels of fungal and bacterial activity and are associated with high losses in digestibility and dry matter. The ammonia-treated bales and 1% propionic acid-treated

Table 1. Temperatures reached and dry matter, and digestibility losses observed after 2 months storage of treated and untreated second growth alfalfa hay.

Treatment	Highest temperature reached	Dry matter lost	Final digesti-bility†	Digestible dry matter loss†
	C		%	
Original samples	--	--	70.9	--
Controls	46	15.1	59.6	20.1
0.02% propionic acid*	45	16.7	61.7	19.9
0.2% propionic acid*	38	13.2	61.6	17.4
0.5% propionic acid*	36	11.7	59.9	17.9
1.0% propionic acid*	33	7.6	65.5	10.3
Anhydrous ammonia	32	9.9	65.5	11.2

*Percentages represent amount of chemical added as % of total original weight of hay as it went into storage. †Each value is mean of determination on six samples, one from each of six bales assigned to each treatment.

bales showed the lowest losses of dry matter, percent digestibility, and digestible dry matter. They compare favorably with the original samples which, of course, underwent no deterioration in storage. Ammonia-treated bales were 3.49% total N (21.8% crude protein) and original hay samples were 2.54% (15.9% crude protein) so some N from the ammonia was retained in the treated hay.

Some of the ammonia-treated bales were fed to dairy cows who ate it without hesitation and with no apparent ill effects. Other animal feeding trials must be conducted to determine whether there are any detrimental effects from long-term feeding of hay preserved with ammonia or propionic acid.

In another preliminary experiment, 300 kg of wet baled alfalfa hay (52% moisture) which had heated to 63C was treated with 5 kg anhydrous, gaseous ammonia. The temperature of the hay began to drop immediately and within 48 hours was below 35C, in contrast to untreated bales which continued at very high temperatures for 2 weeks. This suggests that anhydrous ammonia might be used to control temperature increase in hay which has been stored too wet and might in this way protect against the danger of spontaneous combustion.

In summary, anhydrous ammonia and propionic acid may have potential as hay preservatives. Further research is necessary to determine optimum rates, frequency, methods of application, and effect on animals.

Agronomy Journal 66:823-824.
November-December 1974.

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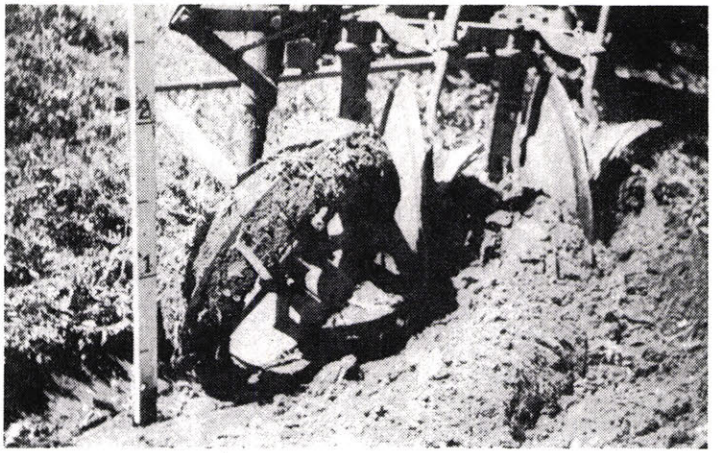
Vetch for Green Manure— Time to Reconsider?

J. T. COPE, JR., *Dept. of Agronomy and Soils*



BEFORE WORLD WAR II, winter legumes were widely grown in Alabama to furnish nitrogen for cotton and corn. Then synthetic N became available in adequate amounts and at low cost, and farmers shifted to commercial nitrogen. Now there is renewed interest in legume green manure crops since inflation and the energy crisis combined to push fertilizer N prices to high levels.

Fortunately, research on value of turning under legumes had been continued by Auburn University Agricultural Experiment Station so up-to-date information is available. Results of these tests at the Brewton and Monroeville experiment fields show that legume nitrogen is just as good as 90-120 lb. of commercial N for both cotton and corn. Thus, the choice between sources can be made solely on the basis of cost and convenience.

Three Cropping Comparisons

Vetch plots have had winter legumes with applications of 90 and 120 lb. N from ammonium nitrate for continuous corn, continuous cotton, and for a 2-year rotation of corn and cotton. Data in the table are from the last 11 crop years, excluding years when drought or some other factor limited yields to less than 40 bu. corn or 1,500 lb. seed cotton.

Vetch plots have had winter legumes continuously since 1931. Plots receiving 120 lb. N had no legumes for this period but have received fertilizer N since 1948. Uniform applications of phosphorus and potassium were broadcast each year in the spring when vetch was turned; pH has been maintained at optimum levels. Vetch was planted as early as corn and cotton stalks could be cut. It got no fertilizer.

CORN. Vetch turned for green manure is a satisfactory source of N for corn. As shown in the table, yields from vetch were about the same as from 90 N and averaged only 3 bu. less than from 120 lb. N at both locations. Vetch supplied adequate N for corn in most years. Even though vetch growth was not good every year, residue from previous vetch crops supported good yields. Under farm conditions, however, it is a good idea to apply some N when the winter legume fails. This will assure an adequate supply of N.

COTTON. Yields of continuous cotton preceded by vetch were slightly higher than from 90 or 120 lb. of N at both locations. Even in 1974 at Brewton when no vetch was produced, residual N from previous vetch crops produced over 2 bales per acre. In that year, N in addition to vetch residue increased cotton yield 440 lb. In most years, however, additional N did not increase yield of cotton.

ROTATION. Rotating corn with cotton did not increase corn yields at either location. Cotton production was not increased by rotation at Brewton, but at Monroeville, where yields were lower, there was an average increase of about 200 lb. seed cotton when rotated with corn. Yields of corn and cotton grown with legume N were about the same when crops were rotated as when each was grown continuously.

Choice Available

Findings for 11 years at the two locations establish that vetch turned for green manure is equivalent to 90 to 120 lb. of fertilizer N for both corn and cotton. There was no distinct advantage to either crop from a 2-year rotation, since yields were just as good from continuous cropping. The choice between using legumes or fertilizer N can be made by comparing costs and convenience. Use of legumes may again become desirable if N costs remain at present levels or increase and if legume seed are available at reasonable prices.

COMPARISON OF LEGUME NITROGEN AND COMMERCIAL NITROGEN FOR COTTON AND CORN, TWO LOCATIONS, 1964-74

Treatment	Corn yield per acre					Seed cotton yield per acre				
	Brewton		Monroeville			Brewton		Monroeville		
	1971[1]	10-yr. av.	1968[1]	10-yr. av.	Av.	1974[1]	10-yr. av.	1970[1]	10-yr. av.	Av.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Continuous cropping										
120 lb. N	**119**	**88**	81	61	**77**	3,440	2,210	1,810	1,720	1,980
90 lb. N	111	81	79	61	73	**3,630**	2,310	**2,110**	1,740	2,040
Vetch + 60 lb. N	**118**	**86**	**88**	**67**	**78**	3,400	2,260	1,990	**1,820**	2,050
Vetch only	107	80	82	**65**	74	2,960[2]	**2,370**	2,050	**1,830**	**2,110**
Cotton-corn rotation										
120 lb. N both crops	**111**	76	83	66	72	3,450	2,060	2,240	1,840	1,960
90 lb. N both crops	**110**	**89**	79	61	**78**	3,640	**2,350**	2,260	1,940	**2,160**
90 lb. N cotton/vetch-corn	100	81	79	62	73	3,610	2,320	1,790	1,790	2,070
Vetch-cotton/vetch-corn	96	77	81	64	72	2,870[2]	2,170	2,510	**2,010**	2,090

[1] Best year at each location; best yields in bold type.
[2] Vetch was total failure at both locations in 1974.

Highlights of Agricultural Research Vol. 22, No. 3. Auburn University, Alabama.

-VLM-

MOISTURE CONTENT OF BLENDED MATERIALS

Charles M. Milne
Agricultural Engineer
Montana State University

In the storage and processing of agricultural crops, it is often desirable to blend two materials at different moisture contents together in order to produce a blended material at an optimum moisture content.

One such application could be the following. If a farmer has five tons of wheat at 18% moisture content, how much wheat at 12% moisture must be added to produce a blend at 14% moisture?

Another example arises in making silage. How much straw at 10% moisture content should be added to each ton of freshly-cut corn silage at 82% moisture to produce a blended material at an average moisture content of 70%?

Other similar applications arise from time to time.

Before considering the solution of these problems, it should be pointed out that all moisture contents herein are expressed on the wet basis. That is, for a given sample:

$$\% \text{ moisture} = \frac{\text{weight of moisture}}{\text{total sample weight}} \times 100$$

Moisture contents are sometimes expressed on the dry basis, which is a different system. The equations to be presented below will not work for dry basis moisture contents. Fortunately, wet basis moisture contents are usually used for crops (though not for soils), so this should seldom present a problem.

The solution of problems such as those posed above is very simple and can be readily obtained by use of the following formula:

$$\text{Pounds of dry material} = \text{Pounds of wet material} \times \frac{\% \text{ moisture excess}}{\% \text{ moisture deficit}}$$

This, of course, can be readily transposed to:

$$\text{Pounds of wet material} = \text{Pounds of dry material} \times \frac{\% \text{ moisture deficit}}{\% \text{ moisture excess}}$$

Moisture deficit refers to the difference between the desired moisture content and that of the dry material, while moisture excess refers to the difference between the wet moisture content and the desired moisture content.

The solution of the grain storage problem is thus:

$$\text{wt. of 12\% wheat} = 10{,}000\# \text{ of wet wheat} \times \frac{18\% - 14\%}{14\% - 12\%} = 20{,}000\# = 10 \text{ tons}$$

The solution of the silage problem becomes:

$$\text{wt. of straw} = 2{,}000\# \text{ of corn silage} \times \frac{82\% - 70\%}{70\% - 10\%} = 400\# \text{ per ton of wet silage}$$

To verify the correctness of this approach, let's consider the solution of the silage example:

Dry matter = 0.18 X 2000# + 0.9 X 400# = 720#

Moisture = 0.82 X 2000# + 0.1 X 400# = 1680#

2400# = total weight

$$\% \text{ Moisture Content} = \frac{1680}{2400} \times 100 = 70\%$$

The grain storage example can be verified in similar fashion.

Management Guides AG 11.10
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Montana State University, Bozeman

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NEW ALFALFA VARIETIES

WL 311

WL 311 was developed from spotted alfalfa aphid resistant germ plasm that was naturally screened and selected following an anthracnose epiphytotics at Fulton, Maryland during 1966, 1967 and 1968. WL 311 is adapted to the central region of alfalfa production and along the Atlantic coast where anthracnose is a problem. Preliminary tests indicate that this variety is adapted to parts of the inter-mountain and Pacific states regions.

WL 311 is resistant to the spotted alfalfa aphid and pea aphid. It is also resistant to bacterial wilt and shows some tolerance to Phytophthora root rot, rhizoctonia and other root and crown rotting organisms. The diverse germ plasm utilized in developing this variety should enable it to perform well over a wide area.

WL 318

WL 318 is a multiple pest resistant variety adapted to the Central and mid-Atlantic regions of alfalfa adaptation and those portions of the northern and western regions where maximum winter hardiness is not required. Its moderately high levels of resistance to bacterial wilt, Phytophthora root rot, spotted alfalfa aphid and the pea aphid are accompanied by good levels of resistance to anthracnose and leaf spots, and tolerance to Fusarium spp. and other crown and root diseases.

The fall dormancy and rate of recovery after cutting are similar to Flemish varieties, but the superior resistance of WL 318 to Phytophthora and anthracnose, along with its bacterial wilt resistance, enable it to survive and produce profitable yields in many areas after the Flemish alfalfas have thinned

badly or have been eliminated entirely. Forage yields of WL 318 in the year of seeding have equalled or exceeded those of the rapidly establishing Flemish varieties. Thereafter the margin of yield superiority of WL 318 is somewhat proportional to disease pressures of Phytophthora, bacterial wilt and anthracnose.

WL 512

WL 512 is a non-dormant spotted alfalfa aphid resistant alfalfa variety adapted to the southwestern United States and other similar regions. It is moderately resistant to Phytophthora root rot and pea aphids. WL 512 demonstrates more resistance to leaf and stem diseases than standard varieties commonly grown in the area. It also has adequate resistance to several root and crown rotting organisms that affect persistence and high yields in the southwest. Tests to date indicate WL 512 has a marked superiority in yield and longevity where several plant pathogens reduces the performance of standard varieties.

WL 512 may be used to produce fine quality hay, soilage and dehydration.

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ALFALFA CUTTING MANAGEMENT FOR AREAS WITH SEVERE WINTERS

John E. Baylor
Extension Agronomist
Pennsylvania State University

Alfalfa--To Cut or Not to Cut--That is the Question

Late summer is a critical period for harvesting alfalfa. In Central Pennsylvania for example, alfalfa rhizomes are formed during the last week in August and the first week of September. They may be formed slightly earlier in Northern Pennsylvania and slightly later in Southeastern Pennsylvania. Removal of top growth at the time rhizomes are formed cuts down on the number actually laid down. These rhizomes form just below the soil surface and are attached to the basal part of the alfalfa plant called the crown. The following spring these rhizomes develop into the stems and leaves that make the first hay crop of the year.

When a third cutting of alfalfa was made at the full bud stage of maturity during the last week of August in Central Pennsylvania, only 14 rhizomes per plant were formed. Delaying this harvest another two weeks permitted the formation of 22 rhizomes per plant. Since hay yields the following spring are related to the number of rhizomes laid down the previous fall it is obvious that alfalfa should not be harvested during the period of rhizome development. Rhizome formation is only of importance in determining the first crop of alfalfa since subsequent cuttings develop from axillary buds located along the basal stems.

Fall Management

Recent research data indicate that in terms of stand persistence spring and fall cutting management are related. When firest harvests are made at 1/10 bloom or earlier a lenient fall-cutting schedule is necessary to keep stands healthy. This means either completing the last cutting by September 1 (September 15 in Southeastern counties) or deferring this cutting until after a killing frost but before October 15. On the other hand, when first cutting is delayed till mid-bloom there appears to be little or no effect of differential fall cuttings on persistence.

In any case, the last cutting should be made leaving a 4-inch stubble to protect the crown and catch snow for added insulation. Maintaining high levels of fertility (especially potash) is also important to winter survival of alfalfa.

Agronomy Gleanings 11:5, September 1975
Cooperative Extension Service
Pennsylvania State University

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ANNUAL RYEGRASS - EARLY WINTER FEED

Charles E. Wilson
Farm Advisor, Yuba-Sutter Counties

Increasing the carrying capacity for our winter ranges has been one of our major goals for the livestock industry.

For the past two years annual ryegrass has been evaluated on the Sierra Range Field Station for winter grazing. The management of this ryegrass has been unique, as there is a source of water, with which we have irrigated up the grass in the fall and then extended the grazing season by irrigating in the late spring.

Results from this year's grazing trial showed ryegrass yielding 348.2 lbs. of beef per acre. Cleared range land resulted in 56.5 lbs. of beef per acre and on unimproved range we obtained 15.3 lbs. per acre. Last year our results were 396.9 lbs. of beef per acre on ryegrass and 41.8 lbs. of beef per acre on the cleared range.

These results show that we can obtain greater yields per acre on land that can be cultivated and where we can irrigate. In addition we obtain earlier feed. Our data showed that from January 16 to March 19, the ryegrass steers gained 103.3 lbs. apiece, where as the cleared range steers gained 42.4 lbs. apiece and the unimproved range steers gained 34.6 lbs. each. After March 19, the gains were about equal for each test group.

The seed cost for ryegrass would be $9.12 per acre. We used 16 lbs. of seed per acre. Four hundred lbs. of ammonium sulfate was applied, which cost about $28.00 per acre. Additional costs will be land preparation and water.

With the above results it would seem that a cattleman should consider planting ryegrass for winter forage to offset the higher hay costs, obtaining earlier feed, as well as increasing the carrying capacity of their existing acreage.

FAST, CHEAP WAY TO ANALYZE FORAGES

A new, rapid method for determining forage quality has been developed by Karl H. Norris, engineer with the USDA. The analysis can be completed in about one minute at a cost of about $1, compared with a cost of at least $50 and several days for a laboratory analysis as it is now done.

The test involves measuring wave length reflections of infrared light to determine the nutritional components of a ground forage sample. Preliminary results show excellent correlations with the cellulose, fiber, protein, lignin, digestibility, moisture content and intake (how much the animal will actually eat) of the forage.

The speed and cost savings of the new method could benefit research to improve forage quality and aid farmers, by increasing on-farm testing of forage crops. Norris developed the test at the USDA's Agricultural Research Center, Beltsville, Maryland. Forages tested include alfalfa, tall fescue, smooth brome, bermuda-grass, pangola digit-grass and alfalfa-grass mixtures.

Instruments are now on the market that with minor modification could be used for analysis of forages, said Norris. "I visualize the ability to analyze the quality of an entire bale of hay in the future. This would give a more accurate picture of the value of the forage a farmer is harvesting," he said.

American Dehydrators Association
Dehy Bulletin 75-34. August 29, 1975.

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HAY PRESERVATIVES

D. A. Holt, V. L. Lechtenberg, and L. H. Smith

Products are available commercially which can be applied to hay at baling and which are claimed to preserve hay and prevent damage from mold and heat provided the hay is 25% moisture or less when it is baled. These products contain propionic acid as the main active ingredient, with some flavoring agents and other chemicals present in smaller quantities.

Research at Purdue indicates that hay baled at 20 to 25% moisture will fequently cure adequately even without a preservative. Grass hay is more likely to cure properly at these moisture levels than alfalfa hay. Under certain environmental conditions, however, such hay may heat and mold and become a less than satisfactory feed.

Propionic acid was not satisfactory as a hay preservative in Purdue tests unless it was added at least 1% (based on pure propionic acid) of the weight of the hay. This rate is higher than the rates currently recommended for some of the commercial products. We base this conclusion on measurements of dry matter and TDN loss from the hay and changes in nitrogen digestibility. These are important measures of forage quality and provide better estimates of the

effectiveness of hay preservatives than such measures as mold counts and crude protein percentage.

Work at other institutions where these important forage quality measurements have been made suggest that rates of 1.5 to 2.0% may be required to adequately preserve hay at 30 to 35% moisture and even higher rates may be required for hay at 40% moisture. We do not know the effects of these high rates of proprionic acid on the animals which will consume the hay. We expect no adverse effects of propionic acid added at the 1% rates.

On-the-farm comparisons can be useful, providing that those interested make careful measurements of moisture contents, take an adequate number of good sized samples, and make meaningful measurements of forage quality. Good moisture measurements require precise weighing equipment. Adequate drying and weighing equipment for making moisture measurements can be purchased for about $100.00.

Summary

1. For hay between 24-30% moisture apply at least one half pound of actual propionic acid per 50-pound bale. This means that if the commercial hay preservative is only 20% propionic acid add 2½ pounds per bale.

2. For legume hay between 20-25% moisture apply at least one quarter pound actual propionic acid per 50-pound bale.

3. Some hay preservative companies do not state the propionic acid content! Try to obtain this information from the dealer.

4. Generally, grass hay baled at less than 25% moisture and legume hay at less than 20% moisture will keep satisfactorily without a preservative.

5. It is still best to follow good hay making recommendations based on weather forecasts.

6. Acid preservatives do not improve the feeding quality of hay! They should only be used in situations where hay must be baled at high moisture (above 20% for legume hay, and 25% on grass hay).

Agronomy Gleanings, Vol. 11:1 April 1975. Cooperative Extension, Pennsylvania State University.

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ALFALFA JUICE FOR SWINE AND POULTRY

University of Wisconsin research indicates that alfalfa juice protein concentrate has the potential of being a source of at least part of the protein in feed for swine and poultry. According to Professor Howard W. Ream and Dr. Dwayne A. Rohweder, Agronomy Department, Wisconsin, it appears that a juice protein concentrate can be prepared from green alfalfa which is equal to soybean meal in swine rations.

In studies performed with poultry, dried whole alfalfa juice was fed at the 75% dietary level from one day to two weeks of age, and all of the chicks died. However, when heat coagulated alfalfa juice protein concentrate was compared with a standard corn-soybean oil solution, in which the former made up 10.6% of the ration--satisfactory liveweight gains and feed efficiency resulted.

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MORE ABOUT ALFALFA FOR HUMAN FOOD

The University of Massachusetts recently issued a report on work that is being done at the University on the potential of using alfalfa as a source of protein as human food.

The work indicates that alfalfa will produce twice as much protein per acre as soybeans. The University has been working on the project for the past 15 years.

Leaves are stripped from the plant and juice is removed from the leaves. This is then ground to a slurry which is pressed removing about 50% of the water. The residue is then dried and used for livestock feed. The juice is then broken down by a process using molecular weight and this ultimately leaves a material of grayish color that is bland and virtually tasteless and contains 50% protein.

American Dehydrators Association
Dehy Bulletin 75-21, May 30, 1975.

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NUTRIENTS IN SEEDS AND SPROUTS OF ALFALFA, LENTILS, MUNG BEANS AND SOYBEANS

Anne M. Kylen and Rolland M. McCready
USDA Western Regional Research Center
Berkeley, California

Editor's Note: The following was obtained by Dr. Helene Swenerton, Extension Nutritionist, who did the leg work in obtaining this information. We will probably be putting this out as a one-sheet-answer at an early date.

This information was published in the Journal of Food Science 40:1008, September-October 1975. Please give proper credit as to its origin if you make any distribtuion of this information.

Dry seeds and sprouts of alfalfa, lentils, mung and soybeans were analyzed for selected nutrients. Sprouts compared on a solids basis contained calcium, iron and zinc at levels about the same as the seeds while protein was higher and fat content lower in sprouts. Total vitamin C, thiamine, niacin and riboflavin content was higher in sprouts than seeds; vitamin C showing the greatest increase. Cooking slightly lowered heat-labile nutrients in sprouts. Galactose-containing sugars of mung beans disappeared upon sprouting. Based upon chemical analyses, nutrient levels of sprouts compare favorably with other vegetables.

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NUTRIENTS PER HUNDRED GRAMS OF SEEDS OR SPROUTS

Sample	Water	Food Energy	Protein	Fat	Fiber	Ash	Calcium	Iron	Zinc	Thiamine	Riboflavin	Niacin	Ascorbic Acid
	%	Cal.	g	g	g	g	mg	mg	mg	mg	mg	mg	mg
Alfalfa													
Seed	7.4	389	35.1	12.6	7.9	3.1	136	12.9	6.9	1.08	0.58	1.8	26
Sprouts													
Raw	88.3	41	5.1	0.6	1.7	0.4	28.0	1.4	1.0	0.14	0.21	1.6	16
Cooked	87.5		5.1	-	1.7	0.4	28.3	1.4	1.0	0.12	0.20	0.8	11
Lentils													
Seed	9.6	340	26.1	1.6	4.6	2.6	33.0	12.8	4.6	0.72	0.29	3.2	7
Sprouts													
Raw	72.7	104	8.4	0.3	1.1	0.8	12.0	3.0	1.5	0.21	0.09	1.1	24
Cooked	68.7		8.8	-	1.1	0.8	13.7	3.1	1.6	0.22	0.09	1.2	24
Mung Beans													
Seed	10.1	334	22.9	1.4	4.9	3.4	83	11.6	3.8	0.70	0.47	1.8	-
Sprouts													
Raw	85.9	53	4.3	0.2	0.6	0.6	13.0	1.9	0.9	0.14	0.18	1.1	20
Cooked	84.3		4.3	-	0.7	0.6	13.1	1.9	0.9	0.14	0.18	1.2	16
Soybeans													
Seed	8.4	428	38.2	20.1	5.1	4.6	220	1.5	6.2	1.19	0.23	3.0	-
Sprouts													
Raw	73.2	105	12.0	2.6	2.3	3.0	75.0	0.4	1.6	0.32	0.16	1.1	12
Cooked	67.2		13.1	-	2.5	3.2	81.7	0.4	2.1	0.42	0.19	1.1	12

AMERICAN SOCIETY OF ANIMAL SCIENCE

Editor's Note: The following are abstracts of presentations made at the 67th Annual Meeting of the American Society of Animal Science held at Fort Collins, Colorado, July 26-30, 1975.

EVALUATION OF IRRIGATED PASTURE SPECIES

R. O. Savage, Joe D. Wallace and D. H. Williams
New Mexico State University, Las Cruces

Single stands of alta fescue (*Festuca arundinacea*), Jose wheatgrass (*Agropyron elongatum*) and potomac orchardgrass (*Dactylis glomerata*) were grown on 1.8 ha irrigated pastures in northeastern New Mexico during 1973. Each pasture was subdivided into four paddocks of equal size. Nitrogen fertilizer was applied to all pastures at 112 kg N/ha on both May 1 and July 9 while phosphate applications (45 kg P/ha) were made on April 27. Each specie was stocked with five yearling Hereford heifers per hectare and rotationally grazed (7 days on and 21 days off) over a 161-day period from May 16 to October 24. Average daily gains by heifers grazing either alta fescue (.67 kg) or Jose wheatgrass (.62 kg) were higher ($P<.01$) than those on orchardgrass (.50 kg). Forage from one paddock representing each specie was harvested in late July and fed to six yearling wethers in conventional digestion trials. The forages were mowed, sun-cured and baled in the pastures and coarsely-chopped (2 to 3 cm lengths) before feeding. Digestibility of dry matter, organic matter, fiber and crude protein was not significantly different ($P<.05$) among species although the digestible protein content of either alta fescue (14.6%) or orchardgrass (12.5%) was higher ($P<.05$) than that of Jose wheatgrass (9.2%). Using calculated values for methane and urinary energy losses, the metabolizable energy values for fescue, wheatgrass and orchardgrass forages were 2.26, 2.13 and 2.12 Mcal/kg, respectively.

COWS GRAZING ORCHARD, FESCUE OR FESCUE-LEGUME

W. H. Smith, V. L. Lechtenberg, D. C. Petritz and K. G. Hawkins
Purdue University, West Lafayette, Indiana

Hereford cows nursing calves were used to determine the effect of orchard, fescue or fescue-legume pastures on cow and calf performance from 4/21 to 10/8 for each of 3 years--1972, 1973 and 1974. The calves ranged in age from 1 to 65 days when cows and calves were turned to pasture. The number of cows per 10-ha paddock ranged from 18 to 21 head with two replication. Initially, in the spring when the cows were turned to pasture, they were restricted to only half of each 10-ha paddock. Hay was harvested on the other half. After regrowth had occurred, the cows were given access to all 10 hectares. Rotational grazing was employed to nehance the growth of the legumes in the fescue. Orchard and fescue pastures were fertilized with 112 to 125 kg of N per hectare. The ADG (kg), conception rate (%), condition score and udder score were as follows, respectively: orchard, .32, 90, 12.3, 2.0; fescue, .05, 72, 11.0, 1.6; fescue-legume, .31, 92, 12.1, 2.1. The cows grazing fescue showed a significant depression in performance when compared to the group grazing orchard

or fescue-legume. The ADG (kg) and weaning weight (kg) for the calves were as follows, respectively: orchard, .80 and 195; fescue, .58 and 160; fescue-legume, .83 and 194. The calves on straight fescue showed a significant depression in performance when compared to the other two groups. The results showed that fescue overseeded with legumes eliminated the depression in animal performance that occurs when grazing straight fescue, and overseeding with legumes was an effective method of supplying N to the grass.

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GEORGIA RESEARCHER REPORTS ON INTERPLANTING SOYBEANS IN CORN AND SORGHUM SILAGE

Dr. D. C. Cummins of the Georgia Agricultural Experiment Station Department of Agronomy has provided me with a summary of their latest research on interplanting of corn, sorghu, and soybeans for silage. Their objectives and a summary of this research follows.

Objectives

The objectives of this study were to compare yield and silage quality of (1) interplanted corn and soybeans with corn alone; (2) interplanted sorghum and soybeans with sorghum alone; and (3) interplanted corn and sorghum with corn and sorghum alone. The corn-soybean and sorghum-soybean experiments were grown under irrigated and not-irrigated conditions to compare response under different conditions of soil moisture stress.

Summary

Corn-soybeans, sorghum-soybeans, and corn-sorghum mixtures were grown in the same row to determine (1) silage yields, (2) yields when irrigated or not-irrigated, and (3) the digestibility, protein content, and fiber content of the forage. The corn-soybean and sorghum-soybean experiments were grown under irrigated (2 years) and not-irrigated conditions (3 years) in the Coastal Plain at Midville, Georgia, and a corn-sorghum experiment was grown not-irrigated for 3 years in the Limestone Valley at Calhoun, Georgia.

The results can be summarized as follows:

1. Interplanting soybeans in either corn or sorghum did not influence yields compared to corn or sorghum grown alone. Little effect was noted in ear or head, leaf, and stalk composition due to soybeans. This was true under both irrigated and not-irrigated conditions.

2. Protein percentage did not significantly increase with the addition of soybeans to corn or sorghum, although a trend for an increase in protein percentage was always present. The average protein increase for the corn and sorghum ranged from 1.6% for the low plant population (7000 plants/acre corn, 4 pounds/acre sorghum) to 0.8% for the high plant population (28,000 plants/acre corn, 12 pounds/acre sorghum).

3. Little change was observed in *in vitro* dry matter digestibility and fiber content of corn-soybean or sorghum-soybean mixtures compared to corn or sorghum alone.

4. Low plant populations of sorghum (3 pounds/acre seed) interplanted in corn increased forage yields compared to corn alone. Total grain content was decreased in most cases and leaf content always increased with the addition of sorghum to corn.

5. Protein percentage in the corn-sorghum mixture did not differ from that in corn alone, and *in vitro* dry matter digestibility of the mixture was reduced because a high-tannin sorghum was used to reduce bird damage.

These results show that the chances are low for soybeans interplanted in corn or sorghum to increase yields or improve quality of the silage produced. Limitations imposed on chemical weed control due to the presence of soybeans further deem the practice questionable. On the other hand, low plant populations of sorghum interplanted in corn should increase yields if drought or poor stands reduce corn production.

Interplanting of Corn, Sorghum, and Soybeans for Silage. D. C. Cummins. Research Bulletin 150, December 1973. Department of Agronomy Georgia Station, Experiment, GA 30212

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NEW PUBLICATIONS

This listing of publications is for your information. Reprints are not available from the Agronomy and Range Science Extension Office, University of California, Davis. If you wish a reprint, you should write to the Experiment Station or organization listed.

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Ruminants as Food Producers - Now and for the Future. Published by the Council for Agricultural Science and Technology (CAST) as Special Publication No. 4, March 1975. Headquarters of CAST are Department of Agronomy, Iowa State University, Ames, IA 50010.

This publication was put together by a task force made up of 12 eminent scientists from the fields of forages and animal science. CAST is a non-profit organization composed of representatives from the following organizations: American Forage and Grasslands Council, American Meteorological Society, American Society of Horticultural Science, American Society of Agricultural Engineers, American Society of Agronomy, American Society of Animal Science, Association of Official Seed Analysts, Council of Soil Testing and Plant Analysis, Crop Science Society of America, Poultry Science Association, Society of Nematologists, Soil Science Society of America, Southern Weed Science Society, Weed Science Society of America.

The Feasibility of Operating a Stationary Hay Cubing Installation in the Columbia Basin. Edward M. Forster and Eric B. Wilson. Cooperative Extension, Washington State University, Pullman, WA 99163. E.M. 3423, Revised March 1971.

Effect of Maturity Group, Ripening Span, and Planting Rate on the Yield, Ear-Stover Ratio, and Dry Matter of Corn Harvested for Silage. N. A. Clark. Agricultural Experiment Station, University of Maryland. Bulletin 490, August 1973.

A summary of this publication is as follows: Many of the commonly grown hybrids were evaluated over four years as silage corn. These represented open and closed pedigree hybrids and maturity groups from early through late for the Maryland area. Varieties which tolerated heavy planting rates and which had a high ear to stover ratio were compared with taller growing varieties which had a low ear to stover ratio. The study showed that the significant features which characterize a good silage variety are:

1. The ability of a variety to produce high yields of TDN. Generally the highest yields of TDN would be from varieties producing the greatest total yield. It could be possible that a lower yielding hybrid with a greater grain yield might produce more TDN per acre, but the best bet is high total yield.
2. A growth span which allows the corn to mature and reach a total dry matter of 35% or more before the killing frost. This permits the greatest accumulation of dry matter per acre.
3. The ability to resist lodging even at high levels of fertility and heavy planting rates.

Oats for Forage. D. A. Rohweder and E. S. Oplinger. Wisconsin Cooperative Extension Fact Sheet, A2590. January 1974.

Influence of Alfalfa Stand Patterns and Nitrogen Fertilization on the Yield and Persistence of Grasses Grown with Alfalfa. Dale Smith and V. A. Jacques. Wisconsin Agricultural Experiment Station, R2480. April 1973.

Weed Control and Alfalfa Establishment. H. P. Cords. Nevada Agricultural Experiment Station, University of Nevada, Reno. Bulletin B 37, May 1975.

Easy Moisture Test for Forages and Grains. Don Helman. Michigan State Cooperative Extension Service. Bulletin 441, Farm Services Series. December 1972.

The Alfalfa Industry in California. Kirby S. Moulton and Lynn Schell. Cooperative Extension, University of California, Berkeley. Mimeo. 4/25/75.

Adjuvants Decrease Insecticide Hazard to Honey Bees. C. A. Johansen, et al. College of Agricultural Research Center, Washington State University, Pullman, WA 99163. Bulletin 801, November 1974.

Diagnosis of Plant Diseases. Washington Agricultural Experiment Station, Pullman, WA 99163. E.M. 3842, July 1974.

Rates and Depths of Mixing Lime and Fertilizer for Alfalfa. O. H. Long, L. M. Safley, J. O. Odom and H. Morgan, Jr. Tennessee Agricultural Experiment Station, University of Tennessee, Knoxville, TN. Bulletin 495, May 1972.

Potassium Fertilization Studies of Alfalfa in West Virginia in Relation to Yield and Longevity of Alfalfa Stands. R. F. Keefer. West Virginia Agricultural Experiment Station. Bulletin 721T, April 1973.

Evaluation of Cool Season Annuals for Forage Production in Southeast Texas. G. W. Evers. Texas Agricultural Experiment Station Progress Report PR-3248, October 1973.

Suggestions for Weed Control with Chemicals (Agronomic Crops, Perennial Weeds, Fence Rows and Noncrop Areas). J. D. Price. Agricultural Extension Service MP-1059, Part I (Revised 1974). Texas A & M University, College Station, TX.

Vegetation Management in Certified Alfalfa Seed Production--A Progress Report? Bill B. Fischer. Cooperative Extension, University of California, 1720 South Maple Avenue, Fresno, CA 93702.

Fifth Annual Alfalfa Symposium. Sponsored by the Pennsylvania State University and Cornell University with the assistance of the Certified Alfalfa Seed Council, Inc. April 8, 1975. Proceedings available at cost from Dr. John Baylor, Extension Agronomist, Pennsylvania State University, University Park, PA, or Certified Alfalfa Seed Council, Inc., P. O. Box 6066, Bakersfield, CA 93306.

Corn Production. G. F. Sprague and W. E. Larson. Agriculture Handbook No. 322, U. S. Department of Agriculture and Minnesota Agricultural Experiment Station. Revised March 1975. U. S. Government Printing Office, Washington, DC 20402. Price 55¢.

Fifteen Years with Sanfoin. R. L. Ditterline and C. S. Cooper. Montana Agricultural Experiment Station. Bulletin 681, July 1975.

Insect Photography. Roger D. Akre, W. B. Garnett, and Art Antonelli. Washington Extension Bulletin 659, Washington State University, Pullman, WA.

Zinc Status of Animal Feedstuffs Grown in the Columbia Basin Plateau and Adjacent Valleys. Louis C. Bowan and R. R. Allmaras, Bulletin 805, College of Agriculture Research Center, Washington State University. December 1974.

Population Dynamics of Larvae of Alfalfa Leafcutting Bee, Megachile rotundata, in Eastern Washington. Jack D. Eves and Carl A. Johansen. Technical Bulletin 78, Washington Agricultural Experiment Station. June 1974.

Population growth of Megachile rotundata has been reduced in many areas of Washington state by predators and parasites and unusually high mortality in the immature larvae. Predators and parasites can be controlled by effective bee management. Immature larval mortality was not influenced by pesticides, disease, nutrition, or types of leaf pieces. When immature larval mortality was high, the highest percentage of mortality occurred in the 2nd-3rd stage. Mortality in the 2nd-3rd stage increased with increasing hours over 26 C. Bee populations differed in inherent temperature susceptibility. Temperature tolerance of bee larvae may be linked to the parents' tendency to emigrate from static populations.

Growing Alfalfa in Indiana. L. H. Smith and T. E. Thompson. Agronomy Guide (Legumes) AY-199. Cooperative Extension Service, Purdue University, West Lafayette, IN.

Alfalfa, Harvested for Hay, as a Source of Available Nitrogen for Wheat. Armand Bauer and LeRoy Zimmerman. North Dakota Agricultural Experiment Station, Research Report No. 57, June 1975. North Dakota State University, Fargo, ND 58102.