

Value of Urea Tested

as a partial substitute for protein in range supplemental feeding

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A GAIN IN WEIGHT of one pound daily, from weaning until the next green forage season, is a desirable objective if calves are to be sold as yearling feeders, or are to be carried over for grass finish at two years of age.

The recommended allowance to accomplish this gain is six to seven pounds daily of total digestible nutrients, including 0.7 to 0.8 pound of digestible protein.

Partial Protein Substitute

Protein shortage during and subsequent to World War II has greatly increased interest in using urea as a partial substitute for protein in the nutrition of cattle and sheep.

The paunches of ruminants—such as sheep and cattle—teem with microorganisms which can use nonprotein nitrogen for their growth and multiplication. The microbes from the rumen, when cultured, washed, and fed as a source of protein, to rats and dogs, were found to be digested and to have good biological value.

Experiments by various research workers prior to World War II demonstrated conclusively that nonprotein nitrogen could partially replace protein.

For the maintenance of lambs, up to 60% of the total nitrogen required could be supplied through microbiological syn-

thesis from urea. Additions of urea to a basal ration, in amounts equivalent to 12% crude protein, increased growth rate of lambs. Further addition resulted in no further increase in growth but gains were enhanced by addition of true protein. This indicated that rumen synthesis was not rapid enough to meet the requirements for maximum growth rate.

Experimental Tests

Feeding tests were run with weanling heifers on the San Joaquin Experimental Range in 1945 and again in 1946. Estimates of probable protein intake from the range forage were made upon the basis of available analysis and digestion experiments.

Two equal sized groups of heifers were fed with supplements equal in total digestible-nutrient value. One group received natural protein, from range and supplement of cottonseed cake and barley, in amounts less than that required for one pound of gain daily. The other group received additional nitrogen, from urea in straw and molasses, in an amount calculated to make the total intake equivalent to 0.8 pound of digestible protein—the recommended allowance.

The range forage in these experiments consisted mainly of dry broad-leaf filaree

and annual grasses, with some true clovers, rushes, and Spanish clover on the better sites, during the first period of the tests.

When lightly stocked, this previously ungrazed, mature, dry feed supported gains of 0.5 to 0.9 pound daily in weaner calves for two to three months—when they received 0.2 to 0.3 pound of protein and 1.2 to 2.5 pounds of total digestible nutrients in their daily supplements.

Weight Gains

Energy intake, rather than protein deficiency, apparently was the factor limiting gain to these levels, for urea addition or higher protein levels did not improve gain. After this time and until green forage became available, additional urea to bring the potential protein level to 0.5 to 0.6 pound, promoted gains of 0.4 to 0.5 pound daily, while the control groups without urea lost weight.

From the data obtained, it appears that on this type of forage, the minimum digestible protein in supplements for weaner calves, during the first one to three months on the dry feed—depending on rate of stocking and quality of forage—should be equivalent to that in one pound of 41% to 43% protein cottonseed cake—0.33 to 0.35 pound.

If a gain of one pound daily is expected, 2.0 to 2.5 pounds of total digestible nutrients in concentrated form apparently is required in addition to that in the forage consumed. For example, a 500-pound calf cannot be expected to consume much more than 12 pounds of the range forage daily, which would contain in the neighborhood of five pounds of total digestible nutrients—2.5 to 3.0 pounds short of that required for one pound daily gain.

Costs

One-seventh pound of urea contains nitrogen equivalent to one pound of cottonseed cake. Since it is difficult to anticipate exact protein needs under range conditions, it would appear that with urea at \$100 per ton and cottonseed cake at \$100, the use of urea to provide insurance against deficiency would be economical.

Using approximately current prices, 5.0¢ worth of cottonseed cake might be replaced by 0.7¢ worth of urea. The urea, however, has no energy value, and to maintain the same digestible nutrient intake, and rate of gain, as when one pound of cake is fed, addition of one pound of barley costing about 4.25¢ would be necessary, thus nullifying the supposed saving.

The combination of urea with molasses as a cheaper source of energy might be

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SUMMARY OF 1945 UREA FEEDING TEST WITH WEANLING HEIFERS

Group 1, control; Group 2, fed supplements with urea; 11 head in each group; average initial weight, 468 pounds.

Average daily supplemental feed	July 11 to August 14, 34 days		Aug. 15 to Sept. 20, 37 days		Sept. 21 to Oct. 24, 34 days		Oct. 25 to Nov. 21, 28 days		Entire period, 133 days	
	Group No.									
	1	2	1	2	1	2	1	2	1	2
Cottonseed cake, lbs.	0.53	0.53	0.75	0.75	0.75	0.75	0.75	0.75	0.7	0.7
Rolled barley, lbs.	0.18	0.18	0.25	0.25	1.20	1.20	1.76	1.76	0.8	0.8
Straw-molasses mix, lbs.	1.76	1.44	2.5	2.5	2.50	2.50	2.50	2.50	2.31	2.23
Protein intake, lbs.	0.20	0.36	0.29	0.53	0.36	0.60	0.40	0.64	0.31	0.53
TDN intake*, lbs.	1.34	1.20	1.90	1.90	2.64	2.64	3.07	3.07	2.17	2.14
Average daily gain or loss, lbs.	0.52	0.72	0.89	0.81	-0.06	0.37	0.35	0.38	0.44	0.58
Total gain or loss, lbs.	17.8	24.6	32.8	29.9	-1.9	12.6	9.7	10.6	58.4	77.7

* Computed as digestible protein or its assumed equivalent of protein plus urea in the case of group 2.

until its presence cannot be demonstrated by usual methods, although at several points it has persisted in reduced numbers. We can expect very small populations for the next year or so at least.

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FUNGUS FLORA

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some other factor, such as nematodes, pierces or weakens the root, the *Fusarium* is able to enter and cause further damage.

Even if *Fusarium* sp. 1 does not enter the citrus rootlets but grows in close association with them, getting its food material from dead root material, it is in the realm of possibility that it exerts an unfavorable influence on the plant.

When grown on plates it produces a substance which is toxic or antibiotic to other fungi.

If citrus cuttings are placed in a medium in which *Fusarium* sp. 1 has grown, the cuttings die in a short time, whereas cuttings in the same medium, which has not supported fungus growth, remain relatively healthy.

It can be stated that the growth of citrus does influence the nature of the soil fungus population. It is possible that this population directly, or more probably in combination with other factors, may exert a detrimental influence on the growth of the trees. More definite evidence in this connection is currently being sought.

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Approximate Percentage Concentration of Certain Fungi Consistently Isolated from Old Citrus and Noncitrus Southern California Soils

Fungus species	Approximate percentage concentration	
	Old citrus soil	Noncitrus soil
<i>Fusarium</i> sp. 1	19	2
Fungus D1	18	not found
<i>Pyrenochaeta</i> sp.	12	not found
Penicillia (blue-green)	8	19
<i>Penicillium vinaceum</i>	5	6
<i>Fusarium</i> sp. 2	4	1
<i>Penicillium restrictum</i>	4	10
<i>Aspergillus versicolor</i>	2	3
<i>Aspergillus ochraceus</i>	2	1
<i>Mucor</i> sp.	1	2
<i>Aspergillus niger</i>	1	5
<i>Monotospora brevis</i>	1	<1
<i>Aspergillus sydowi</i>	1	2
Fungus M1	1	<1
<i>Sclerotium</i> sp.	1	<1
<i>Penicillium humicola</i>	<1	8
<i>Trichoderma lignorum</i>	<1	7
<i>Penicillium nigricans</i>	<1	3
<i>Rhizopus nigricans</i>	<1	1
<i>Torula</i> sp. 1	not found	2

PARATHION

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ful consideration as was given DDT in the early applications.

It is suggested for the coming season, in order to reduce possible injury to the fruit and foliage, as well as to the operator, that only the wettable and dust formulations of Parathion be employed.

Due precautions should be taken when handling the undiluted material and from the drift of sprays and dusts.

The wettable material in the drum has a very objectionable musty odor but after dilutions in the water in the spray tank it is not so noticeable. A few days after spraying, the odor can hardly be detected in the orchard.

Excessive Dosages Not Needed

There is apparently no purpose served by employing excessive dosages of Parathion. The limits will probably be found between one fourth and 1½ pounds of a 15% wettable powder or equivalents of a 25% wettable powder.

Limited tests with 0.5% and 1% dusts have shown them to be adequate in most instances.

Compatibility

Parathion is on the acid side and is not compatible with strongly alkaline materials. It is not compatible with lime sulfur solution, bordeaux mixture, or oil emulsions.

It is, apparently, compatible with wettable sulfurs, neutral coppers, DDT, rotenone, pyrethrum, lead arsenate, and dusting sulfurs.

No Injury Noted

At the dosages and formulations thus far used in deciduous fruit orchards, Parathion has shown no injury to fruit or foliage, even under high summer temperatures, but much research is necessary before it can be considered entirely safe.

Its use with kerosene or spray oil has not been explored sufficiently on deciduous fruit. Indications are that these combinations may prove injurious.

Residue

Analytical methods for the study of spray residue deposits are known, but as yet very little technical data are available on spray residues.

Spray deposits apparently persist for a period of two to three weeks. There should be no spray residue problem on applications which are made a month prior to harvest.

No tolerance has yet been set by Federal agencies.

Availability

The availability of Parathion, in the coming season, will depend upon the speed at which the manufacturers of the technical material can get under production.

Apparently, Parathion will be available for future seasons, from most of the spray chemical companies, in formulations of wettable powders and dusts.

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UREA

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more favorable economically, as well as providing a safe and palatable vehicle for this unpalatable substance and also favor bacterial activity in the rumen.

Use Probably Limited

In general, it would appear that urea will find a place in beef cattle feeding only when natural proteins are unavailable or when the price differential between protein and carbohydrate concentrates is very wide. To meet this possible use in the future, further tests are contemplated using pelleted materials containing urea.

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