MINNESOTA FEED SERVICE

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Few Changes in 1954 Crop List

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A farmer makes many decisions, but one of the most important is his annual selection of the most productive crop varieties to use. He is aided in this decision by the combined efforts of the plant breeder and the seed grower, who determine and increase the superior varieties so that they are available for his use. It is only through these productive varieties that the investment in plant breeding research pays dividends.

To obtain maximum acre yields, however, the farmer must get quality seed adapted to his locality. There is no "bargain seed." Bargain seed may cause a crop failure, reduce yields, or introduce noxious weeds to a farm.

Tests Determine Adaptability

Extensive tests are conducted by the Minnesota Agricultural Experiment Station not only of varieties developed in its own breeding program but also of varieties coming from other sources. These tests determine which varieties are adapted to Minnesota. They are conducted throughout the state and are concerned with yield and agronomic characteristics such as lodging resistance, maturity, and disease resistance.

Certified Seed Is Quality Seed

Quality seed is important, but how can a farmer be sure he is getting quality seed? The only way is to obtain certified seed conforming to Minnesota's rigid protective seed law. This law requires that factors of quality such as germination, purity, and weed and other crop seed content be shown on the seed tag. This tag is important. It should be read before the seed is bought—not after.

No crop variety will respond the same way to all growing conditions. The performance of any variety may vary from one year to another, depending on soil, weather, fertilizer treatment, and disease infection. There is much interest in obtaining varieties that will produce the best yields year after year.

Use Recommended Varieties

A list of recommended varieties is determined each winter by specialists at the University of Minnesota Agricultural Experiment Station and the branch stations. The recommended varieties are listed and described in *Improved Varieties of Farm Crops*, Extension Folder 22, issued each year. Few changes are in prospect for the next planting season.

WHEAT—Ideal conditions of moisture, wind, and temperature favored the epidemic of race 15B of stem rust in 1953. There are no commercial varieties with resistance to race 15B that will be generally available for 1954 plantings; however, there is hope in the future.

All the recommended varieties of wheat, bread, durum, and winter wheat are susceptible to 15B. Lee and Rushmore, although susceptible, appear to be somewhat less so than the others.

SPRING WHEAT—BREAD — Mida, Lee, Rushmore, and Rival are recommended. Canadian-bred CT-186 (recently named Selkirk) has shown good resistance to race 15B and has been satisfactory in yield and milling and baking results. No seed will be available for general farm use in 1954.

DURUM WHEAT — Carleton, Mindum, and Stewart are recommended.

WINTER WHEAT — Minturki and Minter are recommended.

OATS—The recommended varieties are Bonda, Clinton, Mindo, Shelby, James (hull-less), Clintafe, Andrew, Branch, and Ajax. Andrew, Branch, and Ajax are resistant to race 7 of stem rust while Bonda, Clinton, Mindo, Shelby, James, and Clintafe are resistant to race 8. Since race 7 was the prevalent stem rust in Minnesota during the 1953 season, varieties resistant to race 7 in most instances proved advantageous.

All recommended varieties of oats are susceptible to crown rust, with the exception of Clintafe, which has resistance to all prevalent races of crown rust. Branch and Ajax have moderate resistance to race 45 of crown rust, which has been prevalent in the last few years.

Mo. O-205, although not on the recommended list, has been popular with some growers. It is resistant to race 7 of stem rust and has moderate resistance to race 45 of crown rust. The planting of two varieties, one resistant to race 8 and the other resistant to race 7, would seem to be desirable for 1954.

BARLEY—Most of the barley planted in Minnesota is intended for malting. While both Kindred and Montcalm are recommended, most of the cash grain barley grown is Kindred. When planted strictly for feed, Vantage and Peatland are recommended. These varieties are not acceptable for malting.

FLAX—The varieties recommended are Redwing, Minerva, Koto, B5128, Redwood, and Marine. Redwood, B5128, and Marine are immune to rust. Redwood and Marine are resistant to wilt and have some resistance to pasmo; in fact, Marine is the most pasmo-resistant variety available. B5128 is moderately susceptible to wilt and pasmo.

Redwood and B5128 are late and must be planted early to get high yields. Marine is early and shows up better in late planting than the other varieties. Koto and Redwing are susceptible to rust. Minerva produces well only under favorable conditions.

SOYBEANS — Blackhawk, Capital, Ottawa Mandarin, and Flambeau are recommended. Maturity is a dominant

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factor in adaptation of soybean varieties, so the farmer should be sure to buy the variety adapted to his particular area of the state. For advice on this point he can consult his county agent or Extension Folder 22. In particular he must beware of varieties that give high yields farther south, for such varieties might not mature in his area. And he should not be misled by variety performance during the past summer, for even late varieties matured in the late favorable fall.

RYE — Emerald and Imperial are recommended. They are winter hardy and have exceeded other varieties in yield. Caribou, a variety introduced from Canada, shows promise as a new variety. Dakold is inferior in yield, and Balbo is not winter hardy enough for Minnesota.

ALFALFA—The recommended varieties are Ranger, Ladak, and Narragansett. There will be an adequate supply of certified seed of Ranger this winter at a relatively low price. Ranger is winter hardy and wilt resistant.

Ladak is well adapted to Minnesota. Narragansett is winter hardy but is susceptible to bacterial wilt, so it should be seeded in short rotations only.

BROMEGRASS — Lincoln, Achenbach, and Fisher varieties of southern bromegrass are recommended. Seed supplies of these varieties probably will be limited, so buy early.

RED CLOVER — Varieties recommended are Midland and Wegener. Seed supply of both varieties is limited. The best supply of certified red clover seed is of Kenland, a variety not adapted and hence not recommended in Minnesota.

SWEETCLOVER — Evergreen and Madrid are the recommended varieties. The seed supply of these varieties is relatively limited, but the early buyer should be able to get some.

Balance Needed in Rations

THOMAS W. DOWE*

Ruminants, because of the physiology of their digestive tract, can convert materials unsuitable for human food into products which man can eat. In fact, the cattle and sheep industries rest chiefly on the ability of cattle and sheep to convert forage crops into human food and other products.

A great deal of fermentative, digestive, and synthetic activity occurs in the rumen. Tremendous numbers of microorganisms are found in the rumen where they synthesize vitamins of the B-complex group, they synthesize protein from nonprotein nitrogen, and they convert high-fiber forages into digestible nutrients. The principal organisms are bacteria and protozoa.

The nutritional requirements of the ruminant and the rumen microorganisms are closely related. These requirements are energy, protein or nitrogen, minerals, and vitamins.

Many Factors Affect Gain

A few of the factors affecting the efficiency with which feed is utilized by cattle are its adequacy of essential nutrients, its physical nature, and the relation of easily digested carbohydrates to crude fiber or cellulose in the ration. The inherited capacity of the individual animals to gain or grow and the previous nutritional treatment of the animal are important also.

Broadly speaking life is controlled by heredity and environment. The genetic make-up of each individual sets its production limits, but the nutritional environment largely determines whether the inherent capacity will be attained.

Nebraska Experiment Station trials have revealed wide differences in ability to gain. Gains have varied from about 1.7 pounds per head to about 3.0 pounds daily. Individuals varied greatly in the amount of feed required to make 100 pounds of gain. One group of bull calves, all by the same sire, required 690 pounds of feed per 100 pounds of gain. A second sire group required 849 pounds of feed.

A ration lacking in one or more essential nutrients would not produce gain as efficiently as an adequate ration. An excess of one nutrient may create an imbalance even though the ration is adequate in other nutrients. Oscar Kellner showed in Germany that adding too much starch to a roughage ration materially depressed the digestibility of other nutrients.

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Many of the talks given at the Animal Nutrition Short Course this fall on the St. Paul Campus of the University of Minnesota were so outstanding that we thought they should be brought to an even larger audience. The following two articles are condensed from talks given at that short course. Others will be printed in the February issue of the Minnesota Feed Service.

At Nebraska, cattle on wintering rations were fed adequate phosphorus. The calcium was varied to provide 2 to 1, 4 to 1, 8 to 1, and 12 to 1 ratios of calcium to phosphorus. Two-year average daily gains were 1.3, 1.2, 1.1, and 0.99 pounds per head, respectively.

Heifer calves fed growing rations containing different levels of phosphorus reflect the value of this element in the ration. One group of the heifer calves received 1 pound per head daily of soybean oil meal. They consumed 12.1 pounds of prairie hay and gained 99 pounds per head in 168 days.

A second group received 1 pound of a supplement containing 95.9 per cent soybean oil meal and 4.1 per cent monocalcium phosphate; they consumed 13.8 pounds of prairie hay per head daily and averaged 152 pounds gain per head in 168 days. The phosphorus improved appetite and increased daily gain.

Each Nutrient Important

The associative effect of nitrogen (protein) and phosphorus in cattle rations was shown through experiments with four other groups of heifer calves fed growing rations.

Group 1 received 1 pound of corn grain per head daily as a supplement; these calves ate an average daily ration of 10.3 pounds of prairie hay and averaged 41 pounds gain per head during the 168 days.

Group 2 was fed 1 pound per head daily of a supplement containing 94.2 per cent corn and 5.8 per cent monocalcium phosphate. These calves ate an average of 10.5 pounds of prairie hay per head daily and gained an average of 40 pounds per head.

Group 3 was fed 1 pound per head daily of a supplement containing 86.7 per cent corn and 13.3 per cent urea; these calves ate 12.6 pounds of prairie hay daily per head and gained 99 pounds each.

Group 4 was fed 1 pound of a supplement containing 81.5 per cent corn, 6.0

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Research Increases Poultry Efficiency

H. R. BIRD*

Recent experience has led us to expect a new sensation in the field of poultry nutrition every year. The past 12 months have not lived up to this expectation, but they have produced good solid work necessary to the evaluation of past sensations.

Investigators realize that the nutrition of an animal does not occur in a vacuum but is related to heredity, maternal nutrition, and physical and biological environment.

Antibiotics Hit Harmful Organisms

Even when the growth-stimulating effect of antibiotics was first discovered, it was suspected that these antibiotics produced this effect by their influence on microorganisms in the intestinal tract.

Chicks — Work in England showed that chicks kept in a "new" or "clean" environment grew as well without as with an antibiotic. Notre Dame work showed that the same was true of germ-free chicks. This indicates that the growth-stimulating effect of antibiotics in a complete diet comes from their ability to hold in check the growth-depressing organisms which become established in environments long occupied by chickens.

USDA experiments at Beltsville, Maryland indicate that an antibiotic in a nutritionally complete diet permits better growth because it gives the chick partial protection against potentially harmful organisms while the chick is becoming adjusted to them. After the chick has had time to make this adjustment (four weeks in the Beltsville experiments), the antibiotic can be withdrawn with no ill effect on growth. A chick started in a new environment does not encounter these organisms. If later changed to an old environment without an antibiotic, he also goes through a period of retarded growth.

Hens—Most investigators have found that a dietary antibiotic is of no benefit to laying hens receiving a nutritionally complete diet. A mature bird usually is well enough adapted to the intestinal population so that an antibiotic would not be beneficial.

Effect on nutrient requirements—There are numerous conflicting reports concerning the ability of antibiotics to spare various required nutrients such as thiamine, niacin, folic acid, and protein. Apparently the population of competing organisms varies in different environments, and this would account for the conflicting reports.

Arsenicals Stimulate Growth, Too

Apparently the arsenicals produce their growth-stimulating effects, at least in part, by the same mechanisms as do the antibiotics. The Texas Agricultural Experiment Station found with chickens and the Ontario Agricultural College with turkeys that the antibiotics and arsenicals studied produced parallel effects on growth and intestinal microflora. There is still no explanation for the observation that in many, but not all, tests an antibiotic and an arsenical supplement each other with respect to their effects on growth.

New evidence has been reported on the safety of one arsenical, arsanilic acid. Abbott Laboratories have reported the toxic level for chicks to be at least five times the level now permitted in feeds. Arsenic retention at the permitted intake level was no hazard. Arsenic retention in eggs remained within the safe range even when hens were fed twice the permitted level of arsanilic acid, according to the Michigan Station.

Vitamin B_{12} Important to Dams

Recent research on vitamin B_{12} has shown the importance of maternal nutrition to chick performance. The Maryland Station expresses the relationship as follows: if the dams are fed no B_{12}, the chicks require 27 micrograms per kilogram of diet; if the dams are fed 4 micrograms per kilogram, the chicks need 12; if fed 8, the chicks need 3; and if fed 16, the chicks need none.

Experiments at Beltsville, using radioactive B_{12}, indicate that the B_{12} which the hen stores in her eggs has a great effect on chick performance, especially early in life. These results show that B_{12} is critical during early growth but not during later growth.

Numerous and somewhat conflicting figures for B_{12} requirements have been reported for chicks and breeding hens. Careful study of these figures indicates that under commercial conditions, chicks need about 4 micrograms per pound of feed and breeding hens about 2 micrograms.

Just as the day-old chick's requirements may vary depending on the stores he received from the egg, so the eight-week-old chicken's requirements may vary depending on the stores accumulated during early growth. This difficulty and the greater cost of experimentation with older chicks have discouraged work on this subject.

According to the Eastern States Farmers' Exchange, the eight-week-old chick requires 0.72 per cent of lysine. This figure bears the same relation to the protein requirement (16 per cent) as the baby chicks' lysine requirement (0.9 per cent) bears to its protein requirement (20 per cent). Wisconsin reports indicate that between the ages of 8 and 12 weeks the phosphorus requirement is 0.5 per cent and that between 6 and 12 weeks, the niacin requirement is 5 micrograms per pound of feed.

There are varying opinions on the starting chick's niacin requirements. Results from Maryland and the Ontario Agricultural College indicate a requirement of 18 micrograms per pound. However, a collaborative study by a large number of laboratories showed a requirement of not more than 12 micrograms per pound. Experiments at Cornell, Minnesota, and the Ontario Agricultural College showed that a high level of niacin prevents, or helps to prevent, perosis in ducklings, goslings, and poults. A combination of 20 micrograms of niacin and 5 micrograms of alpha tocophenol added per pound of diet prevented hock disorder in turkeys.

The Michigan Experiment Station has studied hemorrhagic diseases in commercial stocks. The blood of turkeys that were fed a practical diet containing 1 per cent of alfalfa meal failed to clot in the pullorum tube agglutination test. Raising the level of alfalfa meal to 5 per cent restored normal clotting.

The causes of the hemorrhagic disease in commercial flocks remain to be established. But one may speculate on the possible influence of (1) reduced levels of alfalfa meal, the principal dietary source of vitamin K, and (2) dietary antibiotics which might limit intestinal synthesis of the vitamin.

Unknown Factors Also Required

There appear to be at least three unknown factors that are needed for best growth of chickens and that may be present at too low levels in practical diets.

One is supplied by fish meal, fish solubles, meat meal, and to a lesser degree, yeast. There is evidence that some other microorganisms synthesize this factor in greater concentration than does yeast. Deficiency of the factor can be demonstrated quite readily in diets made up of commercial feedstuffs, thus

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indicating that the factor is not widely distributed. The presence of an antibiotic in the diet does not reduce the requirement for this growth factor.

A second factor is found in whey, other milk by-products, and yeast. It appears to be more widely distributed than the first factor because, although deficiency can be demonstrated in practical diets, it is difficult to do so consistently. Requirement for this factor is definitely reduced by feeding an antibiotic. The factor may be orotic acid or a related compound, since in some experiments the effects of this factor have been duplicated by feeding orotic acid.

A third factor is present in fresh forage juice. There is disagreement between laboratories as to whether or not this factor is present in alfalfa meal.

These are not all of the unknown growth factors but these are the three which may be present at adequate levels in practical diets.

Energy Content to Increase

Nutritional science began with energy and protein before the existence of vitamins was known. Research has made it possible to supply the essential minerals and most of the vitamins very economically. The best possibilities for further improvements in economy of feeding lie in more efficient utilization of energy and protein. The chicken is more versatile than supposed in its ability to use different levels and sources of energy. Increased levels of energy in broiler feeds are already an old story, and new changes are being made in laying diets.

At the Connecticut Station two laying mashes were compared, one containing 14 per cent more productive energy per pound than the other, principally because of its higher content of corn. The high-efficiency diet resulted in production of 15 per cent more eggs per unit of feed and a 9 per cent higher efficiency index than the standard diet. Its ingredient cost at prices prevailing in early 1953 was only 5 per cent greater than that of the standard diet.

In experiments at Beltsville, the number of calories of productive energy per unit of laying mash was increased 17 per cent by adding fat to the diet. The efficiency index increased 17 per cent, while the ingredient cost increased only 6 per cent.

One way to increase efficiency of protein utilization is to use synthetic amino acids to correct the deficiencies of feed proteins. Synthetic methionine is already being used in this way. Its practical importance lies in the fact that it is the one essential amino acid not furnished abundantly by soybean oil meal, our principal protein supplement. Another amino acid, lysine, though now too expensive to use in commercial feeds, has possibilities because it is the limiting amino acid of cottonseed, meat, and sesame meals.

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per cent monocalcium phosphate, and 12.5 per cent urea; these calves ate 13 pounds of prairie hay daily per head and gained 141 pounds each during the 168-day period.

In this example both phosphorus and nitrogen (protein) were limiting factors. And the results were limited by the amount of the lowest essential nutrient.

Recently wintering trials were conducted at Nebraska to determine the effects of various supplements when fed along with alfalfa silage. Blackstrap molasses or soybean oil meal was substituted for corn on an equal total digestible nutrient basis. All of the cattle were fed an equal amount of roughage—alfalfa silage or alfalfa silage and alfalfa hay—together with one of these: 4 pounds of ground shelled corn; or 2 pounds of corn and 2 pounds of soybean oil meal; or 3.3 pounds of corn and 1 pound of blackstrap molasses; or 1.4 pounds of corn, 1 pound of blackstrap molasses, and 2 pounds of soybean oil meal per head daily.

The cattle that did not receive molasses made an average daily gain of 1.73 pounds and those that received molasses made an average daily gain of 1.67 pounds per head. In this experiment molasses was of no value.

The cattle that received soybean oil meal made an average daily gain of 1.80 pounds per head, and those that did not receive soybean oil meal made an average daily gain of 1.60 pounds per head. So there was some advantage in substituting 2 pounds of soybean oil meal for 2 pounds of corn. Whether the gain would pay depends on the comparative cost of corn and soybean oil meal.

In recent years the use of dehydrated alfalfa products in cattle rations has increased. The addition of 1 or 2 pounds of dehydrated alfalfa to basic rations of poor roughage increases gains.

The value and effectiveness of beef cattle supplements still depend on the kind and quality of the basal feeds in the rations. Thus, a complex supplement which is highly effective when fed with a given ration in one area may be less valuable when used in a different area with a different combination of feeds. No panaceas have been discovered or compounded and probably the greatest miracle of ruminant nutrition is the ability of the animal to use a wide variety of low-quality feeds.

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