Ag and Food Interprets . . .

- Granulation provides new competition for coke-oven ammonium sulfate
- Herbicide selectivity may stem from application method or physiology
- Water solubility of phosphate fertilizers vital under some conditions
- Problem of labeling medicated feeds may be near solution
- Enzymes going into new uses in foods, beverages, textiles, leather

Competition for Ammonium Sulfate

Granular mixed goods diminish its need as non-caking nitrogen ingredient in fertilizer industry

AMMONIUM SULFATE, long dominant as an agricultural nitrogen material, has fallen victim to a revolution in fertilizer practices. The expansion that has taken place in granular mixed fertilizers is displacing or reducing ammonium sulfate in mixed goods, and opinion in the industry is that this trend, growing out of the rising demand for high analysis fertilizers, will continue.

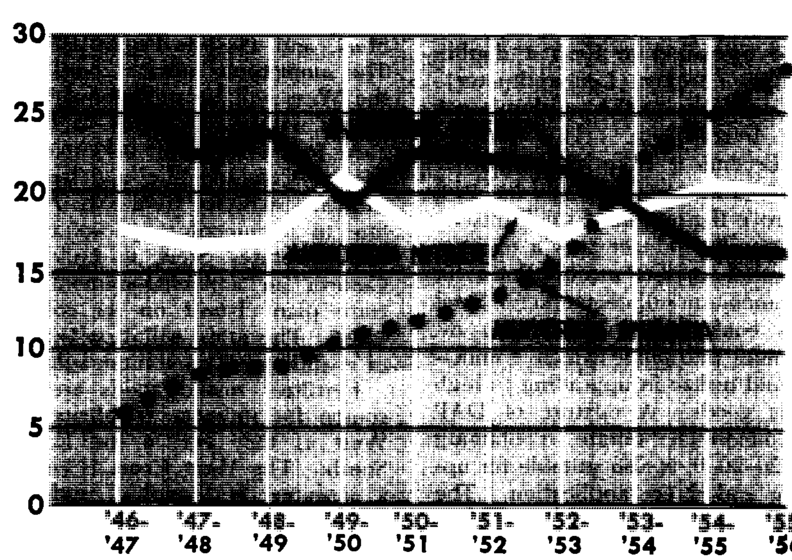
Another roadblock facing ammonium sulfate in the fertilizer marketplace is cost. Ammonium sulfate contains 20.56 to 21% nitrogen; the coke-oven product, prior to the steel strike this year, sold at $32 per ton at producing points. This price represented a reduction of $10 per ton from its 1955 price, but the sulfate is still more costly on a unit basis than nitrogen solutions (a "unit" is 20 pounds or 1% of a short ton).

At $32 per ton ammonium sulfate is equal to $1.55 per unit of nitrogen f.o.b. plant or $1.70 to $1.90, delivered to the mixer. For nitrogen solution the unit costs are $1.40 to $1.60, and those for anhydrous ammonia, on a delivered basis, are $1.05 to $1.20.

Field men in the Midwest contend these figures show rather clearly why the fertilizer mixer will use no more sulfate in his formulations than is absolutely necessary. Before the advent of the granulated mixtures a few years ago ammonium sulfate was the preferred nitrogen material in dry mixed fertilizers. It did not supply the high N percentages demanded today, but it was free flowing and not subject to the caking experienced with the more hygroscopic ammonium nitrate. The competitive value in these advantages has diminished with the appearance of granulation and the rising consumption of nitrogen solutions.

Producers of ammonium sulfate have been slow to recognize the long-term effects of granulation in the Midwest and Southwest, in the view of Alfred Dickinson, Virginia-Carolina Chemical Corp. New plants are now rising for this purpose in the Midwest area, he told a recent meeting of the American Coke and Coal Chemicals Institute, and sulfate producers might experience additional losses in volume. As a result of anhydrous ammonia expansion, coke oven ammonium sulfate

PERCENTAGE OF TOTAL FERTILIZER NITROGEN DERIVED FROM PRINCIPAL SOURCES



currently supplies only about 6% of all agricultural nitrogen consumed.

But is the outlook for ammonium sulfate as dim as these views indicate? In answering this question, Chester Edwards, Nitrogen Products, Inc., says sulfate will definitely remain a factor in the nitrogen market, although on a reduced scale. Even the recent $10 per ton slash in price probably will not recapture the market. However, it must be remembered that the percentage of granulated fertilizers is still relatively small, and as a Midwest producer says, ammonium sulfate "is always available."

Both coke-oven and synthetic ammonium sulfate will remain a market factor, according to Kenneth Horner of the Business and Defense Services Administration, "because of certain favorable physical properties." At the same time, he observes, their unit nitrogen costs compared to other forms of nitrogen will undoubtedly have much influence on their relative positions.

A Southwest ammonia producer notes that in formulations containing more than 10 units of nitrogen it is still the practice in most cases to obtain the nitrogen from sulfate. This practice will continue until more information and experience permit using more solutions in formulation without running into caking problems. It may also be necessary to wait for other forms of nitrogen suitable for granulation to become available at an attractive price. Even an anhydrous ammonia producer grants that ammonium sulfate, "particularly coke-oven sulfate," will continue to furnish part of our nitrogen.

From a producer of granular fertilizer: Ammonium sulfate will remain a factor—definitely. It can be made more acceptable by granulation, especially for direct application. It could also be upgraded to form a double salt of 26% nitrogen (Leunasaltpeter), which would be neither explosive nor highly hygroscopic. The product could become a close competitor of ammonium nitrate and could be used to improve the output of small mixers.

The same producer sees a number of potential ways of meeting losses in the ammonium sulfate market. Steel makers could partly convert to diammonium phosphate which granulators could utilize in upgrading to high analysis goods. A mixture of DAP and ammonium sulfate, containing about 20–20–0, is also suitable for upgrading and direct application. The way also is open to large steel plants to convert to ammonia, nitric acid, and ammonium nitrate. The outlets would be nitrogen solutions and ammonia for direct application. Synthetic nitrogen producers thus must lower their prices on solutions or face still keener competition. They are being watched by the large steel and petroleum companies with free hydrogen, both of which groups are more favorably located to fertilizer markets.

From the Tennessee Valley Authority, Wilson Dam, Ala., comes the contention that the formulation of granular fertilizers is not entirely a matter of price. The formulation must be such that it will granulate satisfactorily. T. P. Hignett, chief of the TVA development branch, division of chemical development, says that in most granulation plants inclusion of a certain amount of ammonium sulfate is the most satisfactory way to obtain well-controlled granulation of high-nitrogen grades.

At present prices it is believed that four units of nitrogen in an 8–8–8 mixed fertilizer can be based on ammonium sulfate and four units on solution. If more than four units are sought from nitrogen solutions there will be a tendency of the mix to cake. As much as ten units of nitrogen can be supplied by solutions, but it may then be necessary to coat the product with anti-caking material. More than ten units of nitrogen in a mixture calls for the use of ammonium sulfate. At TVA the formulation of 10–10–10 and 12–12–12 granular fertilizers usually includes one to five units of nitrogen from ammonium sulfate.

On the West Coast ammonium sulfate will continue to supply nitrogen requirements although lately it has felt the competition of other materials, notably anhydrous and aqua ammonia. This competition may be intensified when new nitrogen capacity is placed on stream by Calspray, United States Steel, and Phillips Pacific Chemical. The ammonium sulfate consumed in the West will be predominantly synthetic, with Kaiser Steel at Fontana soon to be the only coke-oven producer. Colorado Fuel and Iron some time ago switched from coke-oven sulfate to diammonium phosphate, and United States Steel is building at Geneva an ammonia-ammonium nitrate plant based on its coke-oven gases. This move will drop U.S.S. out of coal-derived ammonium sulfate.

Fertilizer mixed goods are not a source for industry problems in the West as they are in the East and South. The West Coast is primarily a consumer of "simples," and N-P-K ratios in the mixtures used differ greatly from those in the East. The Western preference is for synthetic ammonium sulfate, which did not follow the $10 cut in coke-oven sulfate. Synthetic was lowered $3 last spring, making the price $46 per ton f.o.b. plant, bulk.

Ammonium sulfate will continue to be an important item in international trade. Exports in 1955 amounted to 612,000 tons, of which 60.5% was synthetic. Total ammonium sulfate sales in 1955 were 2,041,000 tons. Imports amounted to 173,118 tons.

Ammonium sulfate has maintained its strong position in some other countries despite the growth of competing nitrogen materials. In the United Kingdom it accounts for about three-quarters of all agricultural nitrogen consumed. Ammonium nitrate has enjoyed increased use there in recent years, but mainly as a straight fertilizer along with calcium carbonate in granular form. According to the British Sulphate of Ammonia Federation, compound fertilizers made from ammonium nitrate are inferior in physical condition to those made with ammonium sulfate owing to the hygroscopic properties of the nitrate.

Herbicide Selectivity

Chemical weed killers' selectivity may come from application methods, a plant's physical or growth characteristics, or physiological response of plant

Economics in a direct fashion holds the key to rapidly expanding interest in herbicides for agricultural, industrial, and right-of-way uses. As "hoe labor" becomes less available and more expensive, selective herbicides' acceptance and demand mount among farmers throughout the world. In the U. S. last year, farmers used an estimated $50 million worth of chemical herbicides—largely selective types. Industrial and right-of-way uses were considerably less extensive, and involved mostly non-selective types, although highway departments do aim for broad leaf weed control with retention of grasses for erosion prevention.

The selectivity in selective herbicides may mean many levels of weed killing activity. In some cases, overuse of a selective herbicide will kill all vegetation, while in others general contact weed killers carefully used will have a selective action. Selectivity of application will often substitute for or supplement chemical activity of herbicides. For example, oils directed at the base of cotton plants will control small weeds, but if the oil hits the leaf of the cotton plant, then it too is killed.

Pre-emergence herbicides sprayed after planting will stop weed seeds, normally lodged close to the soil surface, from germinating, and will do so without harming crop seeds—corn or cotton, for instance—planted $1^1/_2$ to 2 inches deep. Solubility of the herbicide will influence activity, also; the less soluble chemicals remain near the soil surface and control shallow germinating weed seeds, but do not reach deep plant seeds or root crops.

If a crop plant possesses a very different structure and growth habit from those of weed plants present, control of the weeds in the crop's presence may take advantage of some or all of these differences. Some herbicidal formulations that will wet or stick only to weeds and not to crops have been used extensively. Cereals have corrugated, waxy leaf surfaces which are narrow and generally almost vertical, making retention of a herbicide difficult. The smooth, broad, nearly horizontal leaves of many weeds, on the other hand, permit easier coverage by and retention of herbicides and eventual killing of the weed plant.

The exposed growing points of broad leaf plants allow easy contact by herbicides during any stage of life, as contrasted with the protected growing points of narrow leaf plants. Cereals, for example, have their growing points located in the plant crown which remains in a protected position below the soil surface. Other plants, alfalfa being a notable example, have a dormant period during which herbicides have little effect. During this dormancy, applications of herbicides to control annual weed plants may be made without crop damage.

The selective herbicides used in largest quantity take advantage of differences in plants' tolerance to toxic chemicals. Those chemicals which can produce many physiological responses in plants—hence their general name of "growth regulators"—are receiving most research attention now. And in 1955, over 100 million acres throughout the world received treatment with growth regulators.

These herbicides, also called "plant hormone chemicals" by some, have definite limitations and will cause serious damage to desirable plants if improperly used. Environmental conditions often cause selective herbicides to perform inconsistently giving rise to charges that they are unreliable. Some (2,4-D, for example) have highly volatile forms which may drift to fields adjacent to sprayed fields and

Some Herbicides under Preliminary Evaluation or in Limited Commercial Use

Chemical Name	*Common or Trade Name*	*Formulation*	*Suggested Use*
4-(2,4-dichlorophenoxy) butyric acid	2,4-DB	Aqueous solution of sodium and amine salts	Weeds in clovers, celery, limited use in cereals
4-(2-methyl-4-chlorophenoxy) butyric acid	MCPB	Same as above	Weeds in cereals, clovers, peas, celery
2-(2,4,5-trichlorophenoxy) propionic acid	Silvex	Water solution of salts or emulsifiable oil solution of esters	Woody plant control by foliage spraying
4-chlorophenoxyacetic acid	4-CPA	Same as above	Similar to 2,4-D or MCPA
3,4-dichlorophenoxyacetic acid	3,4-D	Same as above	Same as above
Sodium 2,4-dichlorophenoxyethyl sulfate	SES or Crag #1	Aqueous solution	Weeds in strawberries, asparagus, peanuts, potatoes
Sodium 2,4,5-trichlorophenoxyethyl sulfate	Natrin	Same as above	No specific crops—for germinating weeds
2,4-dichlorophenoxyethyl benzoate	Sesin	Wettable powder	Same as above—higher residual effects than Natrin
2,3,6-trichlorobenzoic acid	....	Aqueous solution of salts or oil solution of acid	Weeds in corn Woody plants control
Sodium 2,2-dichloropropionate	Dalapon	Aqueous solution	Control of grasses in uncultivated land
Sodium 2,2,3-trichloropropionate	....	Same as above	Control of grasses in uncultivated land and in beets, onions, carrots, legumes
3-(4-chlorophenyl)-1,1-dimethyl urea	CMU or Monuron	Wettable powder	Low concentrations for weeds in asparagus, high concentrations for control of all plant growth
3-(3,4-dichlorophenyl)-1,1-dimethyl urea	3,4-DDU or Diuron	Same as aqueous dispersion	High concentrations for control of all plant growth
3-phenyl-1,1-dimethyl urea	PDU	Wettable powder	High concentrations for control of all plant growth
Isopropyl-N-(3-chlorophenyl) carbamate	CIPC or Chloro-IPC	Emulsifiable organic solvent solution	Pre-emergence control of grasses
Isopropyl-N-phenyl carbamate	Propham or IPC	Wettable powder or emulsifiable organic solvent solution	Same as above
N-1-naphthyl phthalamic acid	NP	Wettable powder, water solution of sodium salt	Weeds in asparagus, melons, and cucumbers
Disodium 3,6-endoxohexahydrophthalate	Endothal	Aqueous solution	Grasses or as defoliant and desiccant
1,2-dihydropyridazine-3,6-dione	Maleic hydrazide or MH	Aqueous solution of salts	Grasses; prevents sprouting of root crops during storage
3-amino-1,2,4-triazole	3-AT	Aqueous solution	Particularly effective against deep rooted weeds and grasses Cotton defoliant
2-chloroallyl diethyldithiocarbamate	....	Emulsifiable liquid concentrate	Residual pre-emergence control of grasses. Particularly effective in soils high in clay or organic matter as contrasted with most other pre-emergence herbicides, which work best in sandy soils.
1-chloro-*N*,*N*-diethyl acetamide	Randox	Same as above	
1-chloro-*N*,*N*-diallyl acetamide	....	Same as above	

Randox was applied to rows of seed corn in a 22-inch band at rate of 1.5 quarts per acre at planting time. Rains over the next five weeks made mechanical cultivation impossible, but rows remained free of grass and corn was undamaged

cause crop damage. Legislation regulating herbicidal spraying has been the result in a number of states.

Beta-oxidation Mechanism

Another method for obtaining selectivity of herbicides has been recognized. It utilizes the ability of certain plant enzymes to control chemical reactions which convert inactive compounds to ones that will produce growth responses in plants. The process, beta-oxidation, was known as early as 1904 to occur in animals. Among the first researchers to prove beta-oxidation enzyme action in plants, M. E. Synerholm and P. W. Zimmerman at the Boyce Thompson Institute in 1947 showed an inactive growth substance in plant tissues did give growth responses indicating changes in the compound. Seven years later, R. L. Wain of Wye College, University of London, established that certain compounds may be broken down by beta-oxidation within the tissues of one plant species and not in another.

Specific compounds tested so far at Wye College under Wain's direction are chemically related to known growth response herbicides: 4-chloro-, 2,4-dichloro-, 2 methyl-4-chloro-, 3,4-dichloro-, and 2,4,5-trichloro- derivatives of gamma-phenoxybutyric acid related to the derivatives of gamma-phenoxyacetic acid—MCPA and 2,4-D. Susceptible plants possess enzymes which convert butyrics to acetics, killing the host plant. Wain's work indicates that certain of these butyrics proved effective for weed control with such crops as clover, carrots, and celery. If MCPA or 2,4-D is used for weed control with these crops, serious damage results.

Evidence indicates that soil microorganisms degrade the butyric acid derivatives to acetic acid derivatives if washed off plants by rain or if applied to soil. Damage to crop plants may then result from absorption through the roots. To date, however, Wain's experiments indicate little danger with low volume applications of butyrics.

Preliminary experiments in the U. S. with the butyric acid derivatives give rise to speculation that they may prove more effective. Thinking runs that they will translocate more readily (being non-toxic at first) and accumulate in greater amounts in plant tissues before conversion to acetics. Some plant pathologists point out that 2,4-D kills too quickly in perennials, interfering with translocations, and permitting regrowth.

Herbicide Future

Practically every major company manufacturing agricultural chemicals has at least one selective herbicide in general distribution and has extensive screening programs under way to find others. Aims of these programs include greater selectivity—but not beyond the point where selectivity is so limited as to minimize demand—minimum manufacturing cost, and maximum efficiency in action. Vigor of these programs is indicated by reports from some state extension workers that they are behind in testing programs for new herbicidal chemicals developed commercially.

Development of new selective herbicides has proved expensive in the past and continues so. Manufacturers and extension officials point out that as long as weed control with chemicals generally requires selling to farmers, returns on investments in research and in production facilities will continue to be slow.

However, combined research programs aimed at developing better application methods, more effective chemicals, and more knowledge of herbicidal chemical activity will accelerate demand for herbicides. Farmer education in the value and use of herbicides is already a significant factor in demand increase, and it is expected to accelerate demand further.

Water Solubility of Phosphates

Is it important? Agronomists say yes, under certain conditions. But manufacturers are doubtful, point to its upward influence on production costs

The fertilizer industry's stepped-up progress in technology—particularly in granular materials, solutions, and more highly ammoniated mixed goods—was bound to raise the question of water solubility of phosphate materials. Agronomists have long held that under many conditions highly water-soluble phosphates have a higher agronomic value—that is, they produce better yields—than those of low water solubility.

But producing a fertilizer with a high portion of its phosphate in a water-soluble form is more expensive. And fertilizer in this country is sold and guaranteed on the basis of its content of available phosphorus, which includes both the water-soluble and the citrate-soluble phosphorus. In Great Britain and several other countries, phosphates are sold on the basis of their water-soluble phosphorus content.

On the alkaline, neutral, and calcareous soils typical of those in states west of a line extending south from Minnesota's western border, water-soluble phosphates have been found to increase yields. They also have advantages on quick-growing crops such as some vegetables, and on cool-season crops such as wheat.

The theory advanced for the performance of water-soluble phosphate is that it is more mobile in the soil and that plants can thus absorb it more quickly. Actually the zone of phosphate availability around a plant root is quite narrow, compared with that for nitrogen. Thus water-solubles give plants a quick shot in the arm early in the season. For plants with short growing seasons, this boost can be vital to maximum yields.

Cultural practices can minimize or maximize the effects of water solubility. Or, to put it another way, as water solubility is decreased, yields become more sensitive to cultural practices. In Iowa for instance, a highly water-soluble phosphate, placed in the hill with the corn seed, will give higher yields than a less water-soluble one. On the other hand, with broadcast, plow-down placement, there is little difference between the two. This apparent disparity results from the fact that while the water-soluble phosphate when broadcast reacts with the soil, becoming less soluble, it does not react to as great an extent when placed in the hill or row. The solubility effect is lost in one case, while in the other it persists.

Measurements with radioactive phosphorus show that during their early growth, plants may derive from 50 to 75% of their phosphorus from plant foods provided by row or hill placement. Plants are thus enabled to start more rapidly and begin exploiting soil-nutrient reserves sooner than with deeper plow-down applications.

The physical condition of a fertilizer also has some bearing on the yield response to phosphates of different water solubilities. TVA work with granular fertilizers shows that considerable difference exists between yields of short-season crops (oats and Sudan grass in the greenhouse and wheat forage in the field) with fertilizer in different size granules of low and high water-soluble phosphates. Small granules are best with low water solubility, while large granules are best with high water solubility. Even on acid soils there is a distinct difference in early growth response of long-season crops, but this difference does not carry through to final yields.

Variation in water solubility of phosphate fertilizer applied in hill at planting time made this difference in early corn growth in Iowa. Plants on left received 30 pounds P_2O_5 per acre from superphosphate (90% water soluble) and those on right received comparable rate from a nitric phosphate (2% water soluble). This early response from water soluble often does not carry over into final yields

Thus, many agronomists prefer a phosphate fertilizer with high water solubility under some conditions. But they will also admit it has its disadvantages. That portion of the water-soluble phosphate not assimilated quickly by the plant is changed by soils having a high phosphorus fixing capacity into water-insoluble forms not readily utilized by crops. Thus, a help in one instance becomes a hindrance in another.

Some phosphate manufacturers have their doubts about the importance of water solubility and are sometimes inclined to deprecate its value. But they are concerned about it. Those manufacturers who make highly water-soluble forms such as phosphoric acid and the ammonium phosphates (nearly 100% water-soluble) stress this point in their sales messages.

Superphosphates are also highly water-soluble (in the range of 75 to 90%). However, large quantities of super go into the manufacture of mixed goods, and in ammoniation lose half or more of their water solubility. Monocalcium phosphate, a highly water-soluble compound and the one that predominates in superphosphates, is converted by ammoniation to water-soluble ammonium phosphates and the water-insoluble dicalcium and other calcium phosphates.

With ordinary superphosphate, the higher the amount of ammonia absorbed, the lower the water solubility of the product, according to studies by T. P. Hignett of TVA. Addition of liming materials will then decrease water solubility even more. With concentrated super, on the other hand, high ammoniation first tends to depress water solubility, but at still higher rates, water solubility turns upward again.

Better control of drying and cooling would probably enable manufacturers to keep water solubility high, but almost no effort is made to keep water solubility of a fertilizer plant's output at a fixed level, although it is probably kept within a certain range.

Grower Awareness of Solubility

In the East, there is very little sign that farmers are concerned over the matter of water solubility, but in Iowa and in the West, particularly in California, growers are very sensitive to it. The western awareness probably accounts, in part, for the popularity in the West of fertilizer solutions and ammonium phosphates.

Western fertilizer circles, realizing this, were surprised recently when California Spray-Chemical announced it would manufacture nitric phosphates there. Water solubility of the nitric phosphates ranges only up to 30 to 40%, considerably lower than that of the very popular ammonium phosphates. However, Calspray is supporting research on water solubility at state experiment stations in the West. Although not yet complete, this research at the Universities of California and Arizona has turned up data showing that on some soils, particularly those with a high phosphate fixing capacity, acid-soluble fertilizers perform almost as well as the water-soluble ones. One such experiment involved a comparison between an ammonium phosphate (of which over 90% of the phosphate is water-soluble) and a sulfonitric phosphate (with about 10% of its phosphate in a water-soluble form). The latter did as well on a number of soils as did the ammonium phosphate.

Comparisons between the nitric phosphate that Calspray will produce and phosphoric acid indicate there is no significant long-term difference between their capacities to release phosphate.

The question of phosphate solubility thus remains a matter of individual cases and individual judgment. Its answer depends, as do the answers to so many fertilization questions, on the soil, the crop, and the individual farmer's practices and capabilities.

Labeling Medicated Feeds

Proposed relabeling of two types of feeds offers practical solution to long-standing problem

Efforts to resolve the problem of labeling medicated feeds are beginning to show results. A general agreement on relabeling certain types of feed was reached by industry, state feed control, and Food & Drug Administration representatives during a midsummer conference. Behind the conference was the fact that in many instances, current methods of labeling medicated feeds are unsatisfactory to feed manufacturers, to control officials, and—of prime importance—to feed purchasers.

For the present, classifications which will undergo relabeling include feeds that are purchased by the farmer primarily for the purpose of supplying adequate rations and preventing disease in livestock and poultry, and products which are bought when a purchaser is confronted with a specific disease problem. Labeling for concentrates, supplements, and premixes which contain drugs and medications at different levels for various other purposes (such as growth stimulants) are expected to be considered sometime before the end of 1956.

Basically, under the proposed new labeling, a feed manufacturer's brand name and type of feed will receive top emphasis, which they do not always receive under today's labeling methods. For complete feeds that are to be fed continuously as the sole ration, the manufacturer can use his regular brand name. The names of drugs found in the feed do not have to appear as a part of the brand name. But directly under the brand name, the word "medicated" must appear and reference must be made to the nature and purpose of the medication in the feed. For feeds falling under the second type—those containing therapeutic levels of drugs to be fed for short periods such as three to seven days—the word "medicated" must appear in the brand name.

Additional clearance is still necessary before the proposed labeling for these types of feeds can be used. The American Feed Manufacturers Association hopes that the new labeling can be completely cleared and put into effect by next January 1.

When is a feed not a feed?

The problem of medicated feed labeling came about after the transformation of the feed manufacturer into a manufacturer of drugs-in-a-feed-vehicle. Essentially, the problem is: should a feed containing a few milligrams of a drug per ton be considered simply as a feed, or as a drug?

With FDA, a medicated feed had to be—and still must be, at this date—labeled as a drug. FDA has consistently advised manufacturers to designate feeds by brand names which are not misleading, and which inform the purchaser that the products are drugs in a feed base. On the other hand, the feed manufacturer finds that after spending time and money promoting his own brand name, the drug designation takes first place while the brand name appears in the middle or at the bottom of the label. And too often, according to the manufacturers, the only name for a drug ingredient is a long chemical term or possibly a trade-mark name which is not public property. However, FDA permits the use of familiar nicknames or abbreviations.

According to one of the nation's larger feed companies, the basic ob-

Current labels emphasize drug nature of feed. Product name is in middle of the label

XYZ

4-nitrophenylarsonic acid mixture

Active drug ingredient:
4-nitrophenylarsonic acid.....0.0375%

For the prevention of blackheads in turkey flocks

Incorporated in XYZ Turkey Grower

GUARANTEED ANALYSIS

INDIVIDUAL INGREDIENTS

Directions for Use
(may appear on reverse side)

Manufactured by
XYZ Mills, Inc.
Doeville, Illinois

Proposed label for medicated feeds which are fed continuously as sole ration. No restriction on position of brand or trade-mark. Word "medicated" must follow product name

XYZ

XYZ TURKEY GROWER

MEDICATED

For the prevention of blackheads in turkey flocks

Active drug ingredient:
4-nitrophenylarsonic acid....0.0375%

GUARANTEE OF DRUG CONTENT

INDIVIDUAL INGREDIENTS

Directions for Use
(may appear on reverse side)

Manufactured by
XYZ Mills, Inc.
Doeville, Illinois

Label proposed for medicated feeds that are to be used for a limited time as sole ration. Word "medicated" is first word of product name, and is the same size and face type

XYZ

Medicated XYZ Poultry Worming Mix

For removal of large roundworms from chickens and turkeys

DRUG INGREDIENT

Nicotine sulfate (as alkaloid).....0.1%

GUARANTEED ANALYSIS

INDIVIDUAL INGREDIENTS

Directions for Use
(may appear on reverse side)

Manufactured by
XYZ Mills, Inc.
Doeville, Illinois

jection to existing labeling is the emphasis on the drug nature of a product. The particular feed may be the only nourishment the animal receives in its lifetime. In this way, the feed is entirely different from ordinary carriers that are used for regular drug administration. A drug company that supplies several kinds of medications to feed manufacturers maintains that medicated feed tags have become so complicated and so difficult to understand that not many feeders know exactly what is contained in the feed, even assuming that the tag has been studied.

Another stumbling block which seems to be on the way out since the conference is the difference in individual states' requirements for labels. FDA regulations for medicated feed labeling are supposedly adopted by the states. But from the different types of tags that can be found, it seems that this is not the case. Some states require more "warnings" on tags. Others even specify the size of type to be used for printing labels. The over-all situation, says a southern producer, becomes complicated and confusing.

Manufacturers have no objection to listing the active drug ingredient, intended purpose, adequate directions, and any necessary cautions or warnings that may be needed. But concensus is that one label, acceptable by all state agencies, is possible.

A simpler tag, as envisioned by many, would give the feed manufacturer's brand due recognition, would be distinctive enough to be easily recognized as identifying a medicated feed, would state in simple terms exactly what drugs the feed contains, and to what livestock or poultry it should be fed.

Although the proposed label could be used for most medicated feeds, a problem still remains with feeds containing the growth stimulating hormone diethylstilbestrol. Antibiotics also are used as growth stimulants, but they do not fall into the category requiring special labeling when used solely for this purpose. Currently, unless a feed contains more than 50 grams of antibiotic per ton, the feed is not classed as medicated.

Industry and government representatives agree on the necessity for further work in this area, as well as on other types of medicated feeds labeling which are not covered by the new proposals. FDA claims that it is willing to cooperate in any attempt to design an all-around label—as long as it fulfills the necessary requirements. Feed manufacturers are, of course, more than willing to strive in this direction.

In agreeing on a simplified label, all concerned agree that the picture is considerably improved over that which existed only a few months ago. Reaction of the industry to the proposed new labeling procedure has been favorable. FDA and state feed control officials in many cases appear to be satisfied. Says AMFA, "Great progress has been made toward practical solutions of medicated feed labeling problems that have confronted and frustrated the industry for several years."

Enzymes in Industry

Food and beverage industries finding new uses for these versatile catalysts; big volume going into textiles and leather processing

WELL KNOWN enzymes are finding increased use in food processing and in other industrial applications. In addition, new and unique enzyme preparations are being developed and commercialized. Behind this trend is accelerated research, by both producers and potential users, into the intriguing subject of enzyme action.

Enzymes are made only by living cells. They are essential to life. Every agricultural product in the natural state therefore contains the enzymes it has made for its own use. The research problem, simply stated, is to separate these enzymes from microbial, plant, or animal products and to determine in which industrial processes the preparations can be of value. Although the number of producers of commercial enzymes is not large, competition is keen.

Enzyme action is characterized by its catalytic nature and by its specificity. Best results are usually limited to narrow ranges of temperature and pH. Even brief exposure to high temperatures (75 to 100° C.) inactivates most enzyme preparations.

Food and Beverage

The importance of enzymes in food processing has long been recognized. Certain enzymes must be destroyed if foods are to be preserved. Others, essential to the natural flavor, are frequently destroyed simultaneously. Enzymes are then seen as the key to natural flavor in these processed foods. Herein may lie a potentially big market for a new group of enzyme preparations.

Flavor Restoration

At this year's annual meeting of the Institute of Food Technologists, the Army Quartermaster Research & Development Command and Evans Research & Development Corp. issued a joint progress report on the use of enzymes for flavor restoration in dehydrated foods. According to this report, the natural fresh flavor of raw cabbage can be restored to dehydrated cabbage by treating it with an enzyme preparation made from mustard seeds. Watercress blanched with steam and dehydrated in an oven can also be restored to natural flavor and odor by rehydration and addition of the mustard seed enzyme. Other food products and enzyme preparations are under study.

In Chicago, at the American Meat Institute Foundation, work is in progress to find proteolytic enzymes that will best tenderize frozen-dried beef steaks. The use of enzymes for tenderizing meat is not new. Natives in tropical areas have used papain for centuries for this purpose. There are today a number of enzyme tenderizing preparations on the market for home and packing-house use. Sausage casings are being treated by enzymes to make them uniformly edible.

An enzyme preparation available today, constituents of which are glucose oxidase and catalase, is being used commercially to catalyze the oxidation of glucose to gluconic acid. To the food processor this means that glucose can be removed in the presence of oxygen or hydrogen peroxide; alternatively the preparation can be used to remove oxygen in the presence of glucose or glucogenic substances. Important application is in dried egg processing. Glucose in dried egg reduces shelf life, decreases solubility, and sometimes causes off-flavors. In other applications this enzyme preparation is being used to remove oxygen from bottled, canned, or packaged food products, thereby increasing shelf life.

Elsewhere in food processing, typical examples of the more common uses of enzymes include: rennet preparations for cheese making; invertase for hydrolyzing sucrose in confectionery; alpha amylase for converting starch to dextrins and sugars; and protease

for modifying wheat proteins in baking.

The brewing industry is an important consumer of enzymes. One familiar application involves the so-called "chill proofing" of beer. Proteoses normally present in beer are soluble at room temperature but precipitate in a cloud if the beverage is refrigerated. Papain and other proteolytic enzyme preparations are used to break down the protein to a point where there is no precipitation on cooling.

Cider and other fruit drinks formerly became hazy because of the presence of pectin. Now enzymes are used to dissolve the pectin and clarify the beverage. Wine makers, too, use a pectinase to reduce juice viscosity and to increase yield.

Textiles, Leather, and Paper

Probably the largest industrial outlet for enzyme preparations is the textile industry. One source estimates as much as 1.5 million pounds per year may be used in this industry. Enzymes are used both in sizing and desizing fabrics. Enzymes reduce the viscosity of starch pastes making them easier to apply and increasing their penetration; other enzymes remove sizing materials from fabrics prior to mercerizing, boiling, bleaching, printing, and dyeing.

Leather bating—a softening process—is another important commercial outlet. Here special enzyme preparations were responsible for a dramatic change in technology. Bating in early times was carried out by soaking dehaired skins in a warm suspension of dog and bird dung. When it became known that proteolytic enzymes were the active ingredients of this obnoxious solution, bates containing such enzymes as pancreatin and papain were substituted.

Paper mills are using starch splitting enzymes in making coated paper. By breaking down large starch molecules sizing pastes of workable fluidity can be prepared. The bacterial amylases are particularly applicable because of wide temperature ranges over which they can be used.

These examples are only indicative of the versatility of enzyme extracts that are commercially available today. What the future holds for these and yet undiscovered products as catalytic agents in industrial processes is not easily assessed. Informed opinion points to increased use in food processing. This may well be a tremendously expanding market over the next few years.