Illinois has long been one of the chief stock breeding and feeding states of the Union. The condition of the cattle breeding and feeding industry of the state has been unsatisfactory for nearly a decade of years. Prices for both pure bred and fat cattle have greatly declined, and while they have temporarily advanced at times, the range of prices for several years past, has been such as to give little or no profit to breeders and feeders as a class. During this time there has been a notable advance in the price of farm land over much of the state, with a corresponding increase in its rental value. While there has been increased attention to the dairy interests of the state, there has been a large decline in the beef cattle breeding and feeding. The number of herds of pure bred beef cattle in the state has decreased, as has the number of cows kept for rearing cattle for fattening. Especially in the great feeding regions of central Illinois, large areas of fine pasture lands have been plowed up and devoted to grain growing.

The conditions surrounding hog breeding and feeding have been more favorable. There have been marked fluctuations in price, but as a whole, a fair margin of profit has been secured by careful breeders and feeders. The present interest in both branches of the business, is perhaps as great as at any former time.

Sheep breeding, during several recent years, was perhaps the most profitable branch of animal industry for many Illinois farmers. In-
creasing numbers of sheep were brought from ranches and ranges of the further west for feeding in the state. Within the last two years, however, there has been a great decline in prices of sheep and wool of all grades, and there is much discouragement among both breeders and feeders.

The widely extended and unusually severe drought of the present summer will have on all branches of the live stock industry, far reaching effects, some of which it is impossible to predict. The lessened aggregate yields of almost all the stock food crops of the country, almost certainly insures fairly high prices for these for the present season, and probably for another year, so far as corn at least is concerned. Wheat is a marked exception in price to the other grain crops. There seems little reason to anticipate any considerable increase in price for this grain in the near future, and already there is large use of wheat as a food for farm animals. The lessened supply and higher price of food in several of the great stock states of the west will tend to increase the number of cattle, hogs, and sheep forwarded to the market, or for feeding in Illinois. It is probable that the effect may be favorable to Illinois breeders and feeders for a few years to come.

Especially in cattle and sheep feeding it is obvious that only the wisest economy can give a satisfactory profit to the Illinois feeders. Economy of production is vastly more important than possibilities of production. An attempt may be made to secure the lessened cost of production, by a reduction of the quantity or cost of the food, land, or labor used.

PRACTICE OF ILLINOIS STOCK FEEDERS.

A record of the practice of experienced and intelligent farmers is invaluable in any discussion of best methods of stock feeding. To secure such a record of practice in Illinois 250 circular letters, containing a series of questions concerning opinions and practice in feeding cattle, hogs, and sheep, were sent to as many farmers in the state. The list of names was made up by the assistance of members of the Board of Direction of this Station, and of the State Board of Agriculture. Answers were received from 108 men, well representing the different classes of stockmen of the state. A few are well known breeders of pure bred stock; some fatten large numbers, others but few animals; some rear all their feeding stock, others buy all or a part. Nearly all parts of the state, except the extreme south, are represented. It is believed very few, if any, of those who sent answers represent any unusual conditions or practice, except in minor particulars.

Of the 108 reporting, 86 feed cattle, 102 hogs, and 44 sheep. Thirty-four report concerning all three classes of stock; 49 concerning cattle and hogs; 13 on hogs alone; three on sheep alone. These figures well illustrate the facts that hog feeding almost invariably accompanies cattle
feeding in Illinois, and that sheep are kept by only a minority of Illinois farmers. Only about one-third of the replies contained reports on sheep; several reports stating that the writers had never owned a sheep.

Much most valuable information was obtained from the replies to the questions sent out; but it is difficult to tabulate this information as some of the questions were somewhat general, and not all were answered directly.

**Cattle Feeding.**

Of the cattle feeders 62 name Shorthorns as the breed preferred or handled; seven name Herefords, six Angus, and one Galloway, as first choice. In a majority of cases it is evident that pure bred cattle are not referred to. In a good number of cases, where a preference is mentioned, it is coupled with statement showing that other classes are handled from necessity. Several reports mention "Durhams" instead of the more usual name Shorthorn. A few dairy farmers reported on hog feeding, but their answers concerning cattle are not included.

Of 77 feeders answering the question, 22 rear the cattle they feed, 27 buy them, and 28 do both.

Of 72 feeders, 26 believe grain feeding to young steers on good pasture is profitable. Several limit their approval of the practice to cases where it is expected to sell the steers within a few months.

Of 83 feeders, 23 make no provision for extra food for grazing cattle in case of drouth, aside from aiming not fully to stock the pastures; 22 reserve a special pasture, and 38 feed grain or hay—usually green corn.

There is a wide divergence of opinion as to age of steers preferred for full grain feeding. Of 80 feeders answering, six name under two years, 11 two years, nine between two and three years, 36 three years, 10 between three and four years, six four years, and two give five years as maximum age. Obviously, making "baby beef" has not become a common practice in Illinois, while it is equally obvious that feeding cattle of four years or greater age is much less common than was the case some years ago.

There is also wide difference in practice as to time when full feeding is begun. Four feeders advise continuous full feeding from birth of the calf. The practice of others is influenced by the fact that they buy the cattle they feed. Each of the four seasons and almost every month of the year are specified by different feeders. The fall months seem most in favor; next the winter or very early spring.

In response to the question "How long is it profitable to continue full feeding?" the answers are somewhat indefinite. Several feeders reply, "'till the cattle are fat"; others that the state of the market determines time of sale; 45 say from three to six months, five, three months or less, and six over six months, one of these giving twelve months as maximum.
Corn is the great food used in fattening cattle, aside from grass and clover. Seventy-eight feeders specify corn, 21 of these naming shock corn; five name oats, four oil meal or cake, and one glucose meal. Twenty name hay, most frequently clover hay, and a very few name straw.

As to methods of preparation, six feeders mention grinding corn, 25 either break, chop, split, or crush the ears, and nine use shelled corn.

As to frequency of feeding, nine feeders name once, 48 twice, four three times, and one, five times a day.

Fifty-five feeders pronounce stable or stall feeding unprofitable, while eleven think the practice profitable. Fifty-two name sheds, four barns, and ten straw stack, hedges, or timber as shelter given their cattle.

Four feeders only state that they have used ensilage, and one of these says, "very little." Of those who refer to time of cutting corn for fodder most prefer cutting at a rather early stage of maturity.

Ten feeders indicate that bran, middlings, oil meal, etc., are used by them; 42 state that they do not use them, or to a very limited extent. The form of the question makes it probable that those who made no reply do not use these foods for fattening cattle.

Fifty-five feeders practice dehorning, many of them indicating their belief in the decided value of the practice; 19 do not practice dehorning and some of these are strongly opposed to the practice. Presumably, those not answering do not dehorn their cattle.

Feeders generally attach high value to the droppings of the cattle as food for hogs. Several state that without the use of this there is no profit in feeding. One thinks there is little value in the droppings where ground feed is used for the cattle. Nine feeders estimate the value of this offal at 50 per cent of the value of the corn fed; five at 33 per cent, and nine at 20 to 35 per cent. One places the value at eight to ten cents per bushel of corn fed; one at three or four lb. pork per bushel fed; one at 30 to 40 lb. pork per month. The number of hogs allowed to follow a given number of steers varies, generally from one to two per steer, depending on size of hogs, rate of feeding and time of year. In a number of cases the brood sows with their litters of pigs are kept with the cattle in the pastures.

**Hog Feeding.**

Hogs are bred and fed on most Illinois farms. Of the 108 farmers responding to the circular sent out, 102 make report as to hogs, although only 13 reported on hogs alone.

The Poland China and Berkshire seem to be sweepingly preferred among breeds—78 naming the Poland China and 21 the Berkshire as breed preferred. Ten of the latter name some other breeds also. Six prefer the Duroc Jersey, two the Chester white, one the Yorkshire, and eight specify some cross. In many cases grades or crosses of the breed
preferred are named as well as the pure bred stock. Only three prefer white breeds.

There is a difference of opinion as to the best season at which to have pigs farrowed, but the majority specify April or May; 25 like March pigs, and 17 name the fall months; six name February.

Concerning no question were more diverse answers received than that asking information as to methods of feeding and managing suckling pigs. Twenty-nine reports state, that no other attention is given than allowing the sows to run on pasture or follow cattle. Of the others some feed corn in various forms, some oats, wheat, bran, middlings, oil meal, rye, and milk in various combinations.

Forty-one feeders believe full grain feeding of pigs is desirable during the summer; 52 believe this is not desirable.

As to pasturage preferred, 51 name clover first or alone; 16, clover and blue grass; seven, clover and timothy; and six, clover and rye.

Where the hogs do not get their food entirely from the pastures and the droppings of the cattle, corn is the almost exclusive food for fattening hogs, and this is generally fed in the ear. Twenty-five soak corn, five mention grinding it, and two speak of cooking food for fattening hogs. Thirty-eight state their opinion that neither grinding soaking nor cooking corn for hogs is profitable. Seventeen report having fed wheat, generally with good satisfaction, only two pronouncing it unsatisfactory. (These answers were given last spring.)

Thirteen feeders believe fattening hogs are not better for exercise; eight think they should have a little exercise; most allow them to take exercise somewhat freely.

Sixteen feeders prefer selling when pigs are eight months old or less—only one naming a less age than six months; 42 name eight to 12 months, and nine prefer over 12 months, 24 being maximum.

Ten feeders prefer selling at weight of 200 lb. or less, 150 lb. being minimum; 15 at from 200 to 250 lb.; 26 at 250 to 300 lb.; and 14 at greater weight than 300 lb.; two naming 500 lb. as maximum.

Sheep Feeding.

Of the 44 farmers reporting their experience in sheep feeding, 18 name the Shropshire, seven the Southdown, six "Downs", five the Oxfordshire Down, one the Hampshire Down, four the Cotswold, one the Lincoln, two the Merino, and five different cross bred sheep as favorite breed—in some cases naming more than one.

As to time at which it is preferred to have lambs dropped, 14 name February, 16 March, and 22 April, three naming January and a like number May, and one December. Evidently raising especially early lambs is not a common practice in Illinois.

Thirty-two feeders say they feed ewes and suckling lambs grain, naming corn, oats, wheat and wheat screenings, and bran. Five do not
feed grain in fattening sheep, 23 feed corn, 26 oats, six wheat or wheat screenings, two bran, and four oil meal in various combinations. Ten have fed wheat at some time, two of these reporting poor results. Seven report their belief that it is profitable to grind grains for sheep.

Twenty-four keep fattening sheep in sheds, seven in barns, and one reports "timber" as the shelter given.

Full feeding of sheep is not continued so long as with either cattle or hogs. Six feeders name two months or less; nine three months and seven three or four months.

**Notes by Feeders.**

A few feeders added statements in addition to answering the questions, or made such statements instead of answering the questions as put. Among these was the well known firm of Shorthorn breeders and cattle feeders, James N. Brown's Sons, of Berlin, Sangamon Co., who wrote:

"... We buy our cattle for fattening and of as good grade as we can secure. We mainly fatten them on blue grass. We buy them in the fall; carry them on rich stalk fields until February or March, and then feed them with corn in the ear on blue grass pastures, generally quitting feeding corn May 10th. We market them in August. We do not handle hogs with them. We would not handle cattle at all, if we did not have the blue grass pastures, as prices the past few years and now, would not pay for fattening them on corn. Men who make beef on corn or dry feed, cannot make money on cattle at present prices."

J. P. Henderson, Virden, Ills., wrote:

"I became tired of the cattle business some four years since, and sold off almost everything in that line, only keeping a few thoroughbred Herefords for fun, and one or two Jerseys for family butter. I am renting out my old pastures for corn, where they have been grazed for over 30 years. I have watched with a great deal of interest, the results of the new methods of feeding and caring for stock, and have never been able to figure out a profit in them, unless indeed, a man were made of some indestructible material and could do all the work himself. The world is all trying to go too fast—feeding cattle at yearlings, and pigs from the day they can open their eyes. We must give them some time to grow and make a frame and then it is easy to put flesh on it. The stalk must grow before the ear is formed."

Benj. Whitsitt, Preemption, wrote:

"In this age of overproduction and low prices, if the feeder expects to place anything on the side of profit, he must feed a limited number of the very best animals and give them the best of care."

James A. Perry, Wilmington, after expressing his decided preference for Hereford cattle, wrote:

"I do not think it profitable to feed cattle in pasture, if there is plenty of good water. For many years I have found it very profitable to put in a good piece of sowed corn for feeding in a dry time. As to the age of cattle for feeding, I find it all depends on the make up of the cattle, as some are better feeders at two years old than are some at four years, even if of the same breed. In general early feeding is the most profitable. The quicker you can mature an animal the more money it will give you. It is not profitable to feed after your cattle are ripe and ready for market. I have made cattle gain five and one-half pounds per day for 60 days, but after that not nearly that average. I have had much more success in feeding ground feed than I have ever had in any other way, and I have tried almost every way and have come
to the conclusion, that to grind corn and cob together, rather fine, is much better than to feed clear meal. I have never had so good results as when I have fed five times per day, but I never feed so the cattle leave the least bit in their feed boxes. Cattle will not eat any more when fed five times a day, than when fed all they will eat at three times, but the advantage is that you do not overload their stomachs and therefore the food is more easily digested and they fatten faster on the same food. I have had better success in feeding cattle kept in their stalls than in any other way of keeping them. I am a great advocate of feeding bran and middlings, and think they are nearly, or quite as good as the same weight of corn. My experience in feeding oil meal is limited. I am greatly in favor of dehorning cattle, as you can feed them in a much smaller space and they will do much better."

Thomas Clark, Beecher, a very successful breeder of Hereford cattle wrote that he thinks it is profitable to feed young steers on pasture if they are to be turned off before they are two years old as he would prefer, commencing full feeding in the spring when they are yearlings, feeding either shelled corn or ground corn and oats, twice a day. He uses a little oil meal for young stock. He does not think stall feeding profitable for a bunch of steers, preferring an open shed with an enclosed yard for winter.

Among the few who use oil meal for fattening cattle to any considerable extent, is O. W. Hoit, Geneseo, who wrote:

"I like to give cattle about five pounds of oil meal each per day. I have fed it on pasture without corn ten pounds per day and made well by it, but consider $25 a ton high with corn at 30 cents a bushel."

F. O. Lash, Hendrix, wrote:

"I believe the farm should be made to produce all the feed needed for the stock, with the exception of middlings, bran, and oil meal, except in times like the present when wheat is cheaper than middlings; but experience has convinced me that much more attention should be paid to the cultivation of beets, mangels, etc."

Thos. N. Thornburg, postoffice not stated, wrote that he feeds 150 to 200 cattle a year, buying them of all the beef breeds. He has cattle on full feed all the year, selling when the market suits, usually feeding from five to seven months, according to the flesh when he commences. Sometimes he buys half fat cattle. He believes it more profitable to handle two or three lots of cattle per year than only one. He tries to avoid selling in the fall in competition with the rush of western cattle, also in March and April.

CONCLUSIONS FROM EXPERIMENTS.

Experiments in feeding cattle and hogs have been continuously in progress at this Station since it was established. Comparatively few of the results have been published because of the belief that in an unusual degree the value of the results of such experiments increases, not only with the number of trials made, but with the number of years during which the experiments are continued, and that the publication of the results of one or a few experiments might readily lead to wrong conclusions. There are many disturbing conditions in experiments with soils
and plants, but the number of such conditions is still greater in the case
of animals. The peculiarities of different animals, and the variations
in seasons, sometimes in the quality and condition of foods supposed to
be practically identical, often greatly affect results. There are also
great practical difficulties in determining accurately the gain in weight,
especially in cattle feeding, or in feeding trials for short periods, or
where there is a marked change in the character of the food given. The
marked variations in the weight of animals, especially cattle, in a single
day, even when the weighings are made as nearly as possible under
like conditions show the experimenter that the apparent results may
not represent the true gain or loss, even when the trial has been con-
tinued for a considerable time.

Without attempting to give details of experiments tried, some con-
clusions based upon the study of them while in progress, and since their
completion, will be stated, special reference being had to conditions in
central Illinois.

It is almost never profitable to attempt to produce the greatest pos-
sible quantity of either weight or fat with any animal. To keep either
steer or hog until it has reached its largest possible size, or to feed either
until it has reached the practical limit of increase of fat, is almost cer-
tainly unprofitable.

Economy of production will be best secured by attempts to reduce
to a reasonable minimum the land used, the cost of the food, and of the
labor employed, rather than by giving attention to any one of these
points alone. Home grown foods are to be used as the chief reliance.
The by-products of oil mills, glucose, starch manufactories, or of dis-
tilleries may often be employed with profit, but usually only as supple-
mental to the main feeding ration. The exceptions to this rule may be
found in the case of farmers who can procure the by-products at little
cost for transportation. Good grass and clover grazed by the animal
is the cheapest food for the production of either beef or mutton. Indian
corn at customary prices, is the cheapest grain food for fattening any
class of farm animals, and in the large majority of cases may wisely
form a part of the grain ration of young animals. Oats are an extreme-
ly valuable food, but, one year with another, the price of this grain is
such as to make it unprofitable to use it as the exclusive or chief food
for farm animals. The value of wheat as food for farm stock, is not
yet fully determined. At present prices, it may more profitably be fed
than sold, but it is confidently believed that, in the great corn growing
region of the state, at least, it cannot be so cheaply raised as can an equal
food value in Indian corn. The stover of Indian corn, clover hay,
and oat straw, with possibly soy beans, and cow peas, and in except-
tional cases millets grown as catch crops, should take the place of timo-
thy or other ordinary grass hay, in horse, cattle, and sheep feeding.

Under conditions available for most Illinois farmers, it is impossible
to feed stock as economically during either winter or extreme heat of
summer, as in the spring or fall. The increased price secured, may often justify feeding during the winter. Grain feeding during the summer is often necessary in the usual cattle feeding system.

Comparatively simple methods of feeding are as yet wisest for the average stock feeder. This applies both to methods of shelter and caring for the animal, and to the preparation of the food. The weight of evidence, both by general practice and by experiments tried elsewhere, is so strongly against the profitableness of cooking food, under ordinary conditions in Illinois, that no experiments in this line have been tried at this Station.

Grinding grain frequently gives a profit. This is especially true where the small grains are to be fed. The evidence is conclusive that feeding unground wheat to either cattle or hogs is a wasteful method, as a considerable percentage passes through the animals undigested. If impracticable to grind it, soaking is advisable. These statements also apply to rye and oats. On the other hand, grinding corn to be fed either to fattening cattle or to hogs is not generally profitable for Illinois farmers. In a majority of cases the animals can grind it more cheaply than can the farmer. Crushing the corn, especially where the ears are large, more generally seems profitable in cattle feeding. Soaking the corn when fed after it has become thoroughly dry is believed profitable. It is assumed that hogs "follow the cattle" when they are fed unground corn; otherwise there is much waste.

Outdoor feeding of cattle is more profitable in good weather than is stall feeding. It is not so clearly proved but is believed that good sheds are a more profitable shelter for steers than the stable.

The old practice of keeping a cow simply to rear calves is no longer profitable. If cattle of equal quality could be secured, "stockers" or "feeders" could be more profitably bought than raised by central Illinois feeders.

The direct increase of weight almost never repays the cost of full grain feeding of cattle, at prices which have prevailed for some years past. Profit must come, if at all, from increase of value of the whole carcass. This should be at least one cent a pound. The value of the pork made from the offal and the value of the manure must also be counted. Grain feeding to young steers on good pasture is not believed to be directly profitable during the best of the grazing season, but in each of the last six years there have been times when such feeding was profitable. Some experiments indicate that it is more profitable to give full rather than partial grain rations to such cattle. In each of six years past the rate of gain of steers even with abundance of grass has greatly lessened on the approach of hot weather, generally about June 20th, and the full rate was not regained until September. It again declined with the approach of cold weather.

Trials for six years indicate that an acre of good "blue grass pasture" in central Illinois will support a steer weighing 800 to 1000 lbs,
during the grazing season, but not allow much, if any, increase. In years of summer drouth extra feed has had to be supplied. Grain fed steers have been kept on one-third less acreage in about the same condition.

Experience during the present and recent dry summers strongly emphasizes the chief weakness of blue grass—its almost entire failure to grow during dry weather. Orchard grass has been found best of the ordinary grasses in this respect, but the common red clover has shown its superiority to any of the smaller grasses for either hay or grazing in dry years. Highly prized as are the old blue grass pastures, it seems clearly proved that a greater quantity of food would be produced by putting them under a rotation, with corn and clover the chief crops. This would involve more labor, but in present conditions would give better prospect of profits.

There is constantly increasing evidence of the great value of corn stover as food for cattle, sheep, and horses and that it may wisely be substituted for a large part of the timothy hay fed farm animals. There are practical difficulties in saving and handling it. While ensilage is largely fed to dairy cows it is little used for fattening cattle. Experiments at this and other stations show that the largest food value per acre is produced, in ordinary seasons, by planting corn more thickly than is the common practice. This reduces the size of the ears and thus removes one objection to feeding ear corn. In many cases it is better to feed the corn without husking. There are a number of feed cutters which satisfactorily cut stalk and ear. Shredding the stalks is preferable to cutting. The cut stover or fodder may be safely stored in barns or sheds in dry seasons, but there is danger of injury if the weather be wet so as to prevent thorough drying. The corn may be shelled and the stalks put in good condition for feed with an ordinary threshing machine.

Several trials show that the quantity of both corn and stover increases until the plant is quite well matured. Early cutting involves a loss. Leaving the corn uncut until fully mature increases danger of loss by storms, the blowing of leaves, etc. Exposure in the fields in shocks very perceptibly lessens the value of the stover. Whatever the method of preparation or class of stock fed it is rarely wise to compel them to eat all the stover of the large varieties of corn mainly grown in Illinois. Twenty to twenty-five per cent need not be considered a large amount for refuse, which may be used for litter or as an absorbent of the liquid manure.

No more rapid or satisfactory gains have been secured in cattle feeding than where steers have been fed the maturing corn in the pastures in September and October, until the stalks had fully matured, they being fed with the ears.

The time for the profitable production of "baby beef" proper has not yet come in Illinois. Usually steers may most profitably be marketed when between two and three years old, if grown by the feeder.
Hog feeding is often directly profitable. No grain has been found superior to corn as a fattening food for hogs. In a majority of experiments tried, a rate of gain of over 10 lb. pork to one bushel of corn has been gained. Where hogs are too long confined to a corn diet alone, or have grown very fat, or are fed in bad weather, the rate of gain often falls far below this. Wheat has not, in trials at the Station, been shown better than corn, pound for pound. There has been noticeable loss when fed unground, either dry or soaked. Pigs have preferred the corn when this has been fed mixed with wheat.

Grass and clover are highly desirable for growing pigs and in early stages of fattening. Their value, however, seems to be more in the way of maintaining health and giving pleasant variety of food than in causing direct increase in weight. It is not profitable to compel hogs to make grass or clover their only food at any stage of their growth.

The evidence in favor of full feeding from birth to time of slaughter seems more conclusive in the case of hogs than with cattle. The market preference as to age and weight changes frequently, but generally it is not desirable to keep hogs until they are more than a year old. The cheapest gain in weight is usually during the pleasant weather in autumn, when the hogs are fed on new crop corn, but prices are usually lowest at this season.

Experience at the Station shows that it is often better to sell hogs in small lots to butchers or shippers than to keep the entire lot until all are fully fat. In some cases this is true with cattle. Fully fattened animals are kept at a loss.

G. E. Morrow, A. M.,
Agriculturist.
INDEX.

Abies excelsa ........................................... 241
Acer dasyacarpum .................................... 233
Acer saccharinum ...................................... 232
Acid test of cream, an .................................. 389
Ailanthus glandulosus .................................. 215
Ailanthus, or tree of heaven (Ailanthus glandulosus) ... 215
Alkaline tablets for testing acidity of cream ........... 392, 399
Apple (Pyrus malus) ..................................... 216
Varieties ............................................. 74
Ash, green (Fraxinus viridis) ......................... 216
Automatic pipette for measuring acid .................. 26
Ayrshire cows, in butter test ......................... 18
Babcock milk test, manipulation of ................... 245
Basswood (Tilia Americana) ......................... 232
Beans, varieties ........................................ 75
Blackberry, tests of varieties ......................... 321
Varieties described .................................... 322
Crystal white .......................................... 344
Early cluster ......................................... 344
Early harvest ......................................... 344
Early king ............................................ 344
Erie .................................................... 343
Freed .................................................. 344
Jewett .................................................. 325
Kittatinny .............................................. 344
Lincoln ................................................. 344
Lovett's ............................................... 344
Lucretia ............................................... 325
Minnewaska ............................................ 323
Missouri mammoth .................................... 333
Snyder ................................................ 322
Wachusett thornless ................................... 333
Wilson, jr. and Wilson's early ......................... 333
Blackberry, see "Orange rust." .........................
Black walnut (Juglans nigra) ........................ 218
Botanical work affecting horticulture ................ 81
Box elder, or ash leaved maple (Acer negundo aceroides) ... 219
Brown's Sons, James N ................................ 426
Brown's Swiss cows ................................... 18
Bur oak, over cup, or mossy cup (Quercus macrocarpa) ... 234
Burrill, T. J ............................................. 81, 244, 301
Butternut, or white walnut (Juglans cinerea) .......... 220
Butter production, see "Milk and butter production." 
Butter tests, see "Dairy experiments;" "Dairy cows."
Carya alba .............................................. 226
Carya sulcata .......................................... 226
Castanea vesca ......................................... 224
Catalpa bignonioides .................................. 221
Catalpa hardy (Catalpa spectosa) ..................... 223
Catalpa spectosa ....................................... 223
Catalpa tender (Catalpa bignonioides) ................ 221
Cattle feeding ......................................... 426
Chesnut (Castanea vesca) ............................. 224
Chinch bug in Illinois, 1891-92 ....................... 44
In southern Illinois, 1894 ........................... 397
Clark, Thomas ......................................... 427
Clinton, G. P ......................................... 295
Corn crossing ......................................... 82, 179, 199, 359
Methods of ........................................... 100
Corn, experiments with ................................ 49, 173, 333
Continuous cropping with corn contrasted with rotation of crops .... 357
Corn fodder, effect of ripeness ........................ 358
Corn plant, rate of growth and chemical composition of the .... 68, 200, 361
Cross fertilization ..................................... 199, 359
Depth of cultivation .................................. 66, 198, 356
Depth of planting ..................................... 194, 353
Depth of plowing ...................................... 65
Effect of fertilizers .................................... 68
Effect of removing tassels ............................ 69, 201
Effect of root-pruning ................................ 66, 198, 357
Frequency of cultivation ............................. 197, 355
Planting in hills or drills ............................ 65, 197, 355
Test of varieties ...................................... 51, 176, 337
Thickness of planting ................................ 62, 194, 353
Time of planting ...................................... 60, 191, 351
Corn seed, loss of dry matter in, by sprouting ....... 380
Cream, see "Acid test of." ......................
Cream separation, etc., see "Dairy experiments," "Dairy cows."
Cross fertilization and hybridizing ............... 77, 82, 179, 199, 359
Dairy experiments ...................................... 9, 17, 137, 245, 359
Composite milk samples tested for butter fat ........ 27
Cream raising by dilution ................................ 30
Cream separation, test of methods .................. 28
Investigations of milk tests ........................ 22
Dairy cows, certified tests of ........................ 400
Dairy cows, tests of, at Illinois State Fair ...... 18
At American Dairy Show ............................. 18
INDEX.

Devon cow, butter test of ........................................... 18
Elm, American or white (Ulmus Americana) .................... 225
Farrington, E. H. .......................................................... 225
Feeding experiments, conclusions from .............................. 427
Fertilizers applied to corn ........................................... 68
Fertilizers applied to wheat (at the Station) .................... 6, 109
Forbes, S. A. ................................................................ 48, 399
Forest tree plantation ...................................................... 205
Cultivation trimming and thinning .................................. 209
Methods of planting ...................................................... 208
Varieties of trees in ...................................................... 208
Histories of—
Ailanthus, or tree of heaven (Ailanthus glandulosus) ........... 215
Apple (Pyrus malus) ........................................................ 216
Ash, green (Fraxinus viridis) .......................................... 216
Basswood (Tilia Americana) .......................................... 232
Black walnut (Juglans nigra) .......................................... 218
Box elder or ash leaved maple (Aegus acer racemosus) ......... 219
Bur oak, over cup, or mossy cup (Quercus macrocarpa) ....... 234
Butternut or white walnut (Juglans cinerea) ...................... 220
Catalpa, hardy (Catalpa speciosa) .................................... 223
Catalpa, tender (Catalpa bignoniodeae) ............................ 221
Chestnut (Castanea vesca) ............................................. 224
Elm, American or white (Ulmus Americana) .................... 225
Hickory, shell-bark or shagbark (Carya alba) ..................... 226
Hickory, big shell-bark or king nut (Carya ovata) ............... 226
Honey locust, or three-thorned acacia (Gleditschia triaen-
onicida) ................................................................. 227
Larch, European (Larix Europaea) ................................... 227
Maple, sugar, rock, or hard (Acer saccharinum) .................. 232
Maple, white, silver, or soft (Acer dorseyi) ......................... 233
Norway spruce (Abies excelsa) ....................................... 241
Osage orange (Maclura aurantica) ................................... 235
Pine, Austrian (Pinus Austriaca) ..................................... 236
Pine, Scotch (Pinus sylvestris) ........................................ 237
Pine, white (Pinus strobus) ............................................ 238
Red cedar (Juniperus Virginiana) .................................... 224
White willow (Salix alba) ............................................ 242
Fraxinus viridis ............................................................ 216
Fungicides .................................................................. 80
Gardner, F. D. 44, 71, 120, 136, 203, 360, 388
Gleditschia triaenoides .................................................. 227
Grafting, see "Root grafting." .........................................

Grape, a disease of ...................................................... 268
Methods of cultivation .................................................. 79
Of training ................................................................. 270
Tests of varieties ......................................................... 74, 249
Varieties described—
Agawan ................................................................. 257
Albert ................................................................. 258
Alphonse .............................................................. 262
Amber queen ......................................................... 258
Aminia ................................................................. 252
August giant ......................................................... 252
Baccus ................................................................. 252
Barbara ................................................................. 262
Barry ................................................................. 252
Beagle ................................................................. 258
Beauty ................................................................. 258
Bell ....................................................................... 263
Brighton .............................................................. 258
Brilliant ............................................................... 259
Cambridge ........................................................... 253
Campbell ............................................................. 263
Centennial ............................................................ 263
Challenge ............................................................. 259
Champion ............................................................. 253
Concord ............................................................... 253
Conqueror ............................................................. 253
Cottage ................................................................. 253
Cynthia ................................................................. 253
Delaware ............................................................... 259
Diana ................................................................. 259
Dinkel ................................................................. 259
Dracut amber .......................................................... 254
Duchess ............................................................... 259
Early market .......................................................... 253
Early victor ........................................................... 254
Eaton ................................................................. 254
Eldorado .............................................................. 263
Elvira ................................................................. 263
Empire State .......................................................... 263
Essex ................................................................. 254
Etta ................................................................. 263
Eumelan ............................................................... 254
Faith ................................................................. 263
F. B. Hayes ........................................................... 264
Gaertner ............................................................... 254
Goethe ............................................................... 260
Gold coin .............................................................. 264
Golden gem ............................................................ 264
Green Mountain ...................................................... 264
Grein's golden ........................................................ 264
Hartford ............................................................... 254
Herbert ............................................................... 260
Huber's No. 12 ........................................................ 255
Iona ................................................................. 260
Iron clad .............................................................. 254
Isabella ............................................................... 255
Ives seedling .......................................................... 255
J. A. Warder ........................................................... 257
Jefferson ............................................................. 260
Jessica ............................................................... 264
Jewel ................................................................. 255
Lady ................................................................. 264
Lady Washington ..................................................... 265
Lindley ............................................................... 260
Larix, Larch, 238
Hickory, 238
Juglans, Hybridizing, 238
Horticulture, 418
Meteorological records, 418
Milk and butter production, daily variation, 9
Milk tests, investigations of, 22
Milk tests, see "Dairy experiments;" "Dairy cows," 137
Milk, variations in, 137
Effect upon of changes in feed of cows, 161
Morrow, G. E., 9, 44, 71, 103, 120, 136, 203, 360,
388, 400, 411, 417, 419, 431
Native fruits, improvement of, 78
Negundo aceroides, 249
New factor in economic agriculture, 301
Nitrogen, free, utilized by plants, 301
Norway Spruce (Abies excelsa), 241
Oats, experiments with, 33, 121, 382, 412
Compact or loose seed bed, 124
Depth of sowing, 35, 127, 386
Effect of time and manner of harvesting on yield and chemical composition, 134, 386
Quantity of seed per acre, 35, 123, 383
Testing varieties, 36, 128
Time of sowing, 125, 383
Orange rust of raspberry and blackberry, 273
Osage orange (Maclura aurantica), 235
Peach tree, winter protection of, 76
Perry, James A, 426
Pine, Austrian (Pinus Austriaca), 236
Pine, Scotch (Pinus sylvestris), 237
Pine, white (Pinus strobus), 238
Pinus Austriaca, 239
Pinus strobus, 238
Pinus sylvestris, 237
Protection of the trunks of trees, 76
Pumpkins and squashes, varieties, 75
Pyrus malus, 216
Quercus macrocarpa, 234
Raspberry, methods of cultivation, 79, 329
Varieties, 74, 325
American black, 326
Brandywine, 327
Carman, 328
Caroline, 327
Clarke, 327
Crimson beauty, 327
Conrath's early, 326
Cuthbert, 327
Early pride, 328
Golden queen, 328
Gregg, 326
Hansell, 328
Herstine, 328
Hilborn, 326
Hornet, 328
Hudson River Antwerp, 328
1894.]

**INDEX.**

<table>
<thead>
<tr>
<th>Page</th>
<th>Name of Variety/Plant/Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>326</td>
<td>Johnson's sweet</td>
</tr>
<tr>
<td>327</td>
<td>Kansas</td>
</tr>
<tr>
<td>327</td>
<td>Lovett</td>
</tr>
<tr>
<td>327</td>
<td>Mammoth cluster</td>
</tr>
<tr>
<td>328</td>
<td>Marlboro</td>
</tr>
<tr>
<td>328</td>
<td>Muskingum</td>
</tr>
<tr>
<td>326</td>
<td>Nemaha</td>
</tr>
<tr>
<td>327</td>
<td>Palmer, acme Palmer</td>
</tr>
<tr>
<td>328</td>
<td>Philadelphia</td>
</tr>
<tr>
<td>327</td>
<td>Progress</td>
</tr>
<tr>
<td>327</td>
<td>Rancocos</td>
</tr>
<tr>
<td>328</td>
<td>Reliance</td>
</tr>
<tr>
<td>328</td>
<td>Shaffer's</td>
</tr>
<tr>
<td>327</td>
<td>Springfield</td>
</tr>
<tr>
<td>329</td>
<td>Stayman's No. 5</td>
</tr>
<tr>
<td>329</td>
<td>Turner</td>
</tr>
<tr>
<td>224</td>
<td>Raspberry, see &quot;Orange rust.&quot;</td>
</tr>
<tr>
<td>302</td>
<td>Red cedar (Juniperus Virginiana)</td>
</tr>
<tr>
<td>80</td>
<td>Root grafting, whole and piece</td>
</tr>
<tr>
<td>421</td>
<td>Russian thistle in Illinois</td>
</tr>
<tr>
<td>242</td>
<td>Salix alba</td>
</tr>
<tr>
<td>315</td>
<td>Schneider, Albert</td>
</tr>
<tr>
<td>425</td>
<td>Sheep feeding</td>
</tr>
<tr>
<td>18</td>
<td>Shorthorn cows, butter, tests of</td>
</tr>
</tbody>
</table>
| 110  | Southern Illinois, wheat experi-
|      | ments in                      |
| 425  | Squashes, see "Pumpkins and 
|      | squashes.                      |
| 427  | Stock feeders, practice of in   |
|      | Illinois                       |
| 425  | Stock feeding in Illinois       |
| 101  | Sweet corn, thickness of planta-
|      | ting, 1891                      |
| 301  | Symbiosis                      |
| 26   | Test bottles, marking           |
| 427  | Thistle, Russian, see "Russian 
|      | thistle."                      |
| 427  | Thornburg, Thomas N.            |
| 232  | Tilia Americana                |
| 225  | Ulmus Americana                |
| 1, 105, 401 | Wheat, experiments with       |
| 6, 109 | Effect of fertilizers, at Station |
| 7, 110 | In southern Illinois            |
| 119  | Effect of time and manner of har-
|      | vesting on yield.               |
| 6, 109 | Depth of sowing.                |
| 411  | Quantity of seed                |
| 402  | Test of varieties               |
| 4, 108 | Time of sowing.                |
| 242  | White willow (Salix alba)       |
|      | Whitsitt, Benjamin             |
|      | Winter protection of peach trees, 
|      | see "Peach trees."             |

All communications intended for the Station should be addressed, not to any person, but to the

**Agricultural Experiment Station, Urbana, Illinois.**

The bulletins of the Experiment Station will be sent free of all charges to persons engaged in farming who may request that they be sent.
ORGANIZATION.

BOARD OF TRUSTEES OF THE UNIVERSITY OF ILLINOIS.

NELSON W. GRAHAM, Carbondale, President.
JOHN P. ALTGELD, Springfield, Governor of Illinois.
DAVID GORE, Springfield, President State Board of Agriculture.
HENRY RAAB, Springfield, Superintendent Public Instruction.
FRANCIS M. McKay, Chicago. ALEXANDER McLEAN, Macomb.
SAMUEL A. BULLARD, Springfield. RICHARD P. MORGAN, Dwight.
JOHN H. BRYANT, Princeton. NAPOLEON B. MORRISON, Odin.
JAMES E. ARMSTRONG, Chicago. ISAAC S. RAYMOND, Sidney.

ANDREW S. DRAPER, LL.D., President of the University.

BOARD OF DIRECTION OF THE EXPERIMENT STATION.

*GEORGE E. MORROW, A.M., Champaign, Professor of Agriculture, President.
E. E. CHESTER, Champaign, of State Board of Agriculture.
E. A. RIEHL, Alton, of State Horticultural Society.
H. B. GURLER, DeKalb, of State Dairymen's Association.
N. B. MORRISON, Odin, Trustee of the University.
ISAAC S. RAYMOND, Sidney, Trustee of the University.

*THOMAS J. BURRILL, Ph.D., Urbana, Professor of Botany and Horticulture.
STEPHEN A. FORBES, Ph.D., Urbana, Professor of Zoology.

THE STATION STAFF.

*GEORGE E. MORROW, A.M., Agriculturist, President of Board of Direction.
WILLIAM L. PILLSBURY, A.M., Urbana, Secretary.
THOMAS J. BURRILL, Ph.D., Horticulturist and Botanist.
STEPHEN A. FORBES, Ph.D., Consulting Entomologist.
DONALD McINTOSH, V.S., Consulting Veterinarian.
GEORGE W. McCluer, M.S., Assistant Horticulturist.
GEORGE P. CLINTON, M.S., Assistant Botanist.
FRANK D. GARDNER, B.S., Assistant Agriculturist.
WILL A. POWERS, B.S., Assistant Chemist.

*Professor Morrow has resigned both the presidency of the Board of Direction and his position as agriculturist of the Station. Professor Burrill succeeds him as President of the Board of Direction after September 1st.