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SWEET POTATO STORAGE IN TEXAS

(Extension Service and Experiment Station Cooperating)

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FOREWORD.

The sweet potato is one of the most important food products grown in Texas and has been steadily increasing in importance since storage houses came into use. Although the sweet potato storage industry is comparatively new, it has been growing fast the last few years. At the present time there are nearly 200 storage houses in Texas with a storage capacity of over 1,000,000 bushels.

In order to enable the sweet potato growers to utilize this product to the best advantage as well as to meet the increasing demand for information about sweet potato storage houses and their proper operation, this bulletin is presented, and it is hoped that the essential points of handling the crop, particularly seed treatment, careful harvesting, grading and storing, will be closely followed, thereby making it possible to successfully conserve and profitably market this important food product.

The type of storage house herein described, known as the "Texas A. and M. College Sweet Potato Storage House," was developed by a committee composed of members of the Texas Extension Service and Experiment Station and is the result of extensive study and data collected on the subject. This type of house has been given a severe test under adverse conditions and has proved satisfactory. It is a simple house to construct and is easily and cheaply operated. If properly handled, it will keep potatoes with a minimum amount of loss from rot and will also give them good shipping qualities.

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FACTORS ESSENTIAL TO SUCCESSFUL STORAGE.

There are several factors which are absolutely essential to successful sweet potato storage and they should be carefully considered in connection with this important industry, in order to be able to keep potatoes, with a minimum amount of loss and also to be able to market them at maximum prices. These factors are; (1) properly constructed storage houses, (2) proper management of storage houses, (3) careful harvesting and handling of the crop, (4) disease control. The importance of these factors cannot be over emphasized and each one will be discussed in detail.

TYPE OF STORAGE HOUSE.

Unit System:—The two houses of 5000 and 15000 bushels each here presented are based on the unit system of 5,000 bushels to each unit. A comparatively small unit is recommended because the larger units in curing houses make successful storage much more difficult. The 5000 bushel unit can be filled in a short time and it is also possible to secure an ample amount of ventilation and with proper management to reduce the losses from rot to a minimum.

Where a storage capacity of only 5000 bushels is desired, the one unit house should be used. For a 15000 bushel house the three unit plan should be used while for a 10,000 bushel house the 5000 bushel plan may be used by doubling the length, thereby making two units. In case a wider house should be preferred, on account of size of lot, the larger plans of 15000 bushels may be used by leaving off one unit. For any house of more than 15000 bushels capacity additional units may be added.

MATERIAL FOR BUILDING.

These houses may be built either of lumber, brick, hollow tile or concrete. However, the plans herewith presented are for a frame building. Lumber has given good satisfaction and is usually the easiest building material to secure. The average carpenter can easily handle it.

The house is constructed on piers which extend about two feet above the ground and there is also a concrete or brick foundation wall which helps to protect the house against severe cold spells and also to maintain a cooler and more uniform temperature during warm spells. With this foundation wall the house can be easily kept warm during the cold weather and also kept cool during the warm weather which is quite important as it is really more necessary in Texas to guard against warm humid

weather during the winter and spring than the severe cold spells in winter. There are openings in this foundation wall to provide ventiliation under the floor. The air then passes into the house through floor ventilators.

Ventilators:—The arrangement of floor ventilators, windows, doors and ceiling ventilators are distinct features of the house. Any or all of these ventilators may be opened or closed when it is necessary to admit or exclude air currents.

Cupola:—The cupola solves the roof ventilation problem by providing a large opening for the escape of moisture laden air and warm air and at the same time by its method of construction protecting the interior of the building from rain. The openings into the cupola are controlled by means of ventilators in the ceiling of the house which can be opened and closed by means of a rope and pulley.

Stove and Flue:— Another distinct and important feature of this house is the method of heating and air circulation, which is accomplished by means of a stove and flue. This is really an adaptation from the modern system of heating school houses. The feature of this system of heating is an opening under the stove, through which the outside air enters from under the house. The air then passes around the jacketed stove, where it becomes heated and dried in contact with the stove. Since warm air is lighter, it will naturally rise to the ceiling and spread to all parts of the ceiling. As it absorbs moisture from the inside air it becomes cooler and hence heavier and falls to the floor whence it escapes by suction through the bottom opening of the flue. By this method a constant and strong circulation of warm dry air may be maintained whenever damp or cold weather makes it necessary to keep windows and ventilators closed.

Crates and Bins:—Formerly bins were used largely for storage purposes but within the last few years, the crate system has become more popular and satisfactory and it is quite likely that in the near future the use of crates for storing sweet potatoes will entirely take the place of bins. In fact the plans of the 15000 bushel house which is wider than the 5000 bushel house, call for crate storage only, while for the 5000 bushel house, plans are given for both crate and bin storage.

There are several advantages of the crates over the bins, viz, (1) the cost of the house is considerably reduced, (2) when the potatoes have been shipped, the empty house can easily be utilized for other purposes, (3) they save extra handling, thereby reducing bruises, (4) being in small containers the potatoes receive more ventilation than in bins, (5) the crates are needed during harvesting and shipping, (6) the potatoes usually keep somewhat better in crates than in bins, although this depends a good deal upon the method of handling. The only advantage of the bin over the crate is that in bins more potatoes can be stored within a given space.

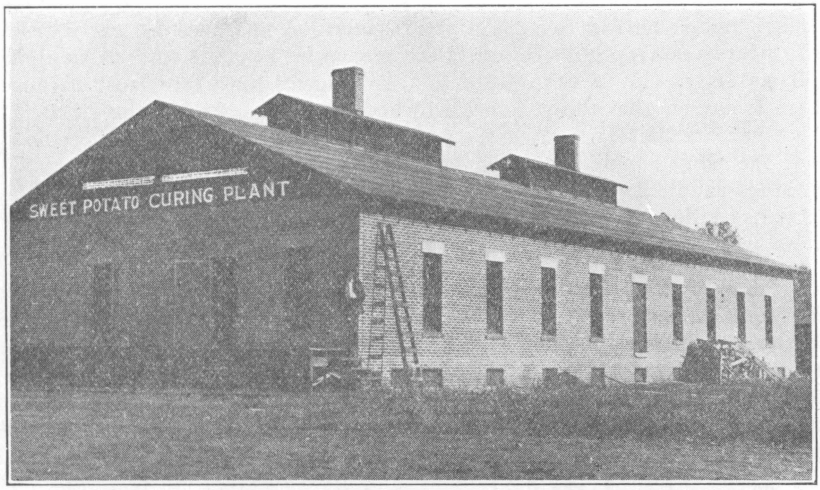


Fig. 1. A. and M. College type of sweet potatoe storage house built of brick and having two units of 5000 bushels each.

PREPARING THE HOUSE FOR STORAGE.

Sometime before harvesting and during a slack time in summer, the house should be carefully overhauled, unless it is new, and any necessary repairs should be made. Broken windows should be replaced and all doors, ventilators and other outside openings made to fit tight. Any leaks in the roof should be repaired and all holes made by rats closed. The stove and stove pipe shoul dbe overhauled and cleaned.

The house should also receive a thorough cleaning so as to remove all the dust and refuse left over from the previous crop. The indoor walls, floor, bins, crates, etc, should be disinfected by spraying with a solution of copper sulphate, also known as blue vitriol or blue stone. This is prepared in the proportion of five pounds of copper sulphate to fifty gallons of water. A good way to dissolve copper sulphate is to place it in a small sack and suspend it in a barrel of water overnight. Only wooden buckets or barrels should be used as this solution will corrode metal. Copper sulphate solution is poisonous when taken internally, hence it should not be left where children or farm animals may have access to it. The spraying may be done with an ordinary bucket pump having a long extension rod and an ordinary nozzle.

The burning of sulphur in the house is effective in controlling mites and in killing rats, but it will not kill the germs that cause diseases in sweet potatoes.

HARVESTING.

A great deal of the success in storing sweet potatoes depends on the way in which the crop is handled in the field. The importance of careful handling cannot be over-emphasized. For storage purposes sweet

potatoes should not be dug until they are well matured, since immature stock is much harder to cure and to keep. Sometimes an early frost will injure the crop but ordinarily the season in Texas is such as to allow full maturity. It is never safe to take chances on a late frost because there is danger that the potatoes will become frost bitten in the field. If the vines are merely frosted the potatoes are still safe for storing; however the vines should be cut immediately at the main stem and then the potatoes should be dug as soon as possible. On the other hand, if the frost has killed the vines to the point of injuring the tips of the potatoes there is little chance of the crop keeping well.

The natural yellowing of the foliage is usually a good indication that the potatoes are ready to be harvested. Another test for maturity is to cut several potatoes and if the cut surface becomes white and dry in a short time the potatoes are mature; if on the other hand the sap continues to flow and remains sticky, it is an indication that the potato is immature. Furthermore the skin of the mature potato cannot be rubbed off as easily as that of the immature one.

The potatoes should be dug as carefully as possible, avoiding all unnecessary bruising. For this purpose a sweet potato digger or a good turning plow with two rolling colters attached to the beam to cut the vines, makes a very handy implement for digging. A "middle buster" with rolling colters also does satisfactory work. A common mistake is made in not going deep enough with the plow and as a result many of the potatoes are cut and bruised. The best time to dig is during dry weather since the potatoes, especially the bruised ones, are more likely to rot when dug while the weather is wet; besides, the potatoes dug during wet weather will be more watery and harder to cure. However, in

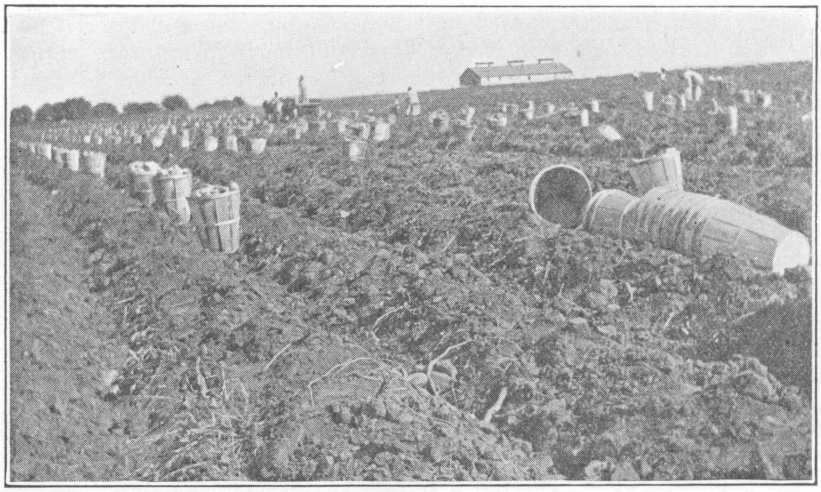


Fig. 2. Harvesting sweet potatoes in hampers. Bushel crates are becoming more popular. Note that the potatoes are carefully placed in the containers from the furrows, to prevent bruising. 15,000 bushel storage house in background.

wet seasons the growers will often be forced to dig when potatoes are wet and muddy. Under these conditions sweet potatoes require extra care in that they must be dried quickly and the moisture not allowed to stay on the potatoes for any considerable length of time. Wet potatoes should never be stored in great bulk but should be spread out in small quantities if possible. It is poor policy to dig the potatoes late in the evening and allow them to remain uncovered during the night in the field as they may become chilled.

The best time to dig is after the sun is well up and not later than three or four in the afternoon or until such time that the grower will be able to pick up all that he has plowed up before night. It is not safe to allow the potatoes to remain exposed long to hot sun although a mild sunlight will help them to dry off. The potatoes should be graded while being picked up. To do so will save time, labor and excessive handling. Some of the pickers should gather the No. 1's and others No. 2's and still others the cut and the jumbo grades and seed potatoes. Mechanical graders are being perfected and no doubt they will play an important part in the future in proper grading of sweet potatoes.

Potatoes should be handled with extreme care and as little as possible if they are expected to keep well. Where storing is done in crates, hampers or baskets it is best to gather the potatoes in these containers carefully without dropping them. They should never be handled in sacks or hauled loose in a wagon box and never hauled in a trot on hard or rough roads. When the potatoes are hauled from the field to the house they should be placed in a spring wagon and carried over the smoothest road, the aim of course being to avoid unnecessary shaking and jarring. If a spring wagon is not available a deep layer of straw or potato vines should be placed in the wagon box. It is very important to prevent bruising, which is mostly caused by rough handling, because bruised potatoes are hard to keep and even if they go through the storage period without rotting they are practically unmarketable on account of their unsightly appearance. Rough handling causes great damage to potatoes for storage and marketing, and this can easily be prevented.

MANAGEMENT OF THE POTATO HOUSE.

Successful sweet potato storage depends partly on the house itself, but intelligent management of the house is a factor which should be considered. It is hoped that those who contemplate adopting the A. and M. unit system will give it careful study. Good management after all is the application of common sense. Where potatoes fail to keep it is easy enough to throw the blame on the house, but in most cases the fault is due to mismanagement or to diseased, bruised or frosted potatoes.

Enough wages should be paid to secure a first class manager for storage houses. Such money is well spent. It does not take the loss of many bushels of potatoes to amount to more than the extra salary required to secure a competent manager.

CURING AND CARE OF SWEET POTATOES IN STORAGE.

The problem of keeping sweet potatoes is the problem of preventing rot producing fungi from growing on them. Since these destructive forms of life require moisture for their development the most important factor in preventing their growth is a thoroughly dry surface. During the first ten days or two weeks of storage a great deal of moisture is given off which generally amounts to 6 or 8 per cent of the original weight of the sweet potatoes. This stage of greatest evaporation is called the curing period. After this, a small amount of evaporation continually goes on but is easily handled.

While it is important at all times that the moisture given off by the potatoes should be driven out of the house, it is especially important during the curing period. In the Texas A. and M. house this is easily accomplished by means of heat supplied by a jacketed stove and thorough ventilation obtained by means of special ventilators. The heat creates air currents in the house and aids in the drying of the potatoes, because when the air which is taken in from the outside becomes warmed, it is given a greater capacity for taking up moisture. In the A. and M. unit house the heat is so distributed that the temperature is practically the same in all parts of the house except that it is somewhat higher at the top than at the bottom, but this difference does not effect the proper curing and keeping of the potatoes.

While a certain amount of heat is essential, this requirement is often misunderstood because potato houses are frequently overheated. Warm air is not necessarily dry air and it will not cure potatoes unless it is dry. After dry air has circulated around the potatoes during curing, it will be moist even though still quite warm and must be allowed to escape with its load of moisture. **The temperature during curing should run from 75 to 80 degrees Fahr. and this same temperature should be maintained as far as possible until complete curing is indicated.** The length of the curing period depends on the condition of the potatoes. If they are grown during a season of high rainfall and dug in wet weather, they will naturally require longer curing than those grown during the dry season and dug when dry. Generally speaking, the curing period lasts from ten to eighteen days, two weeks being an average. It is relatively easy to tell when potatoes are cured by merely rubbing the skin. When it clings firmly and feels leathery to the touch, it indicates complete curing. On the other hand if the skin rubs off easily the curing period should be extended. The appearance of small sprouts is also often an indication that the potatoes are sufficiently cured.

Directions for curing:— The following directions should serve as a guide during curing: While the potatoes are being brought to the house a fire should be kept in the stove if the outside air is damp in order to take care of any sweating of the potatoes. If the weather is dry and warm with a temperature of 70 to 80 degrees it is not necessary to keep up a fire while the house is being filled. In that case all of the doors, windows and ventilators should be kept open.

After the house has been filled, which should be within ten days or two weeks, the main curing period starts. For this purpose, if the weather is bad, the house should be completely closed except the ventilators under the stove and the two ventilators at the bottom of the flue. A fire should be kept in the stove day and night, maintaining a uniform temperature of 75 to 80 degrees, until the potatoes are cured; that is, until the skin feels leathery and does not peel off. If it is hard to keep the humidity below 70 degrees the ceiling ventilators should be opened for short periods to let the damp air out.

By thus keeping the house closed during the curing period a large volume of air is drawn in from under the house and is heated by the stove. Then it rises to the ceiling, spreads out evenly to all parts of the house, being drawn out through the openings in the flue. By this method a good circulation of warm air is maintained in the house and all of the air has to circulate around the potatoes before it can escape through the flue thereby curing all of the potatoes uniformly.

In case the weather during the curing period, is dry and warm, having the desired temperature of 70 to 80 degrees, the fire in the stove is not necessary but instead, all of the ventilators and windows can be opened as the dry warm air from the outside will serve exactly the same purpose in curing, as the air heated by the stove. By consulting the thermometer and hygrometer the manager can easily tell when to use the stove and when to take advantage of the outside air. The first method, that is, by keeping the house closed, works well during wet, cold or damp weather and the latter during warm, dry weather.

If at any time the temperature rises above 80 degrees the house should be cooled by opening as many of the ceiling ventilators and those in the aisles as necessary. This creates a draft which will soon reduce the temperature. However, if the heating is closely watched such a condition should not arise.

In order to maintain the proper temperature in the potato house it is necessary to have three or four reliable thermometers distributed in various parts of the house as otherwise it is impossible to know that the desired temperature is being maintained. In addition to a thermometer, one or two hygrometers are very useful in the proper operation of a sweet potato storage house. The hygrometer indicates the amount of moisture in the air. For example, a reading of 60 indicates that the air around the hygrometer is 60 per cent saturated. The danger point in the potato house is about 70 percent. If the reading is near or above 70, it indicates that the air is too moist. The reading should be maintained below 70 if possible and should generally run between 40 and 65. Both thermometers and hygrometers should be hung up at a height of about five feet. In addition to the indoor thermometer, and hygrometer, it is desirable to have a thermometer and hygrometer outdoors to indicate the temperature and moisture in order to take advantage of all favorable outdoor conditions.

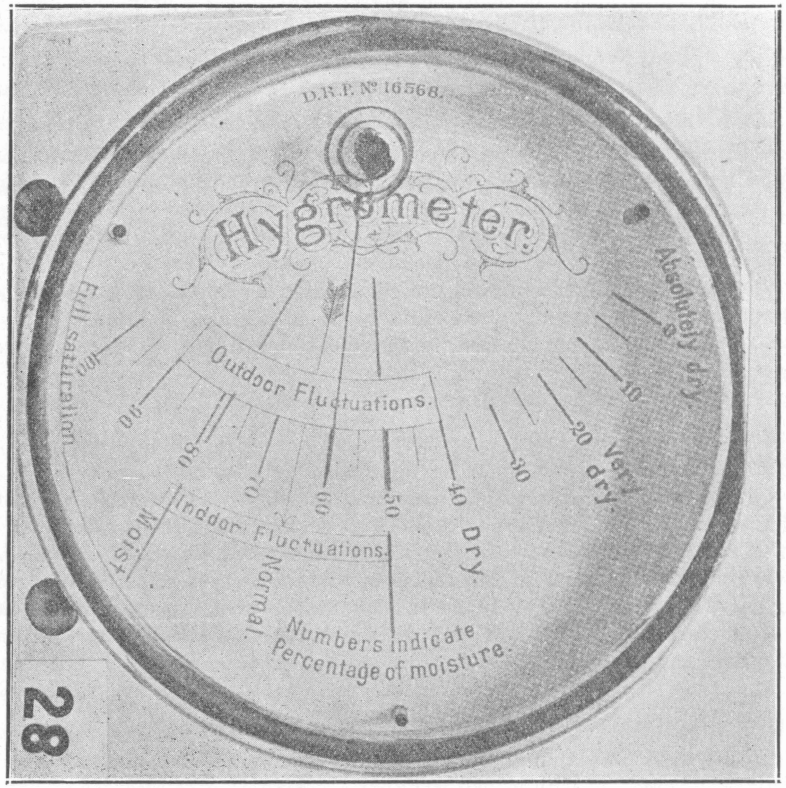


Fig. 3. Type of hygrometer which is very handy for storage houses. It registers the relative humidity of the atmosphere. (Texas Exp. Sta. Bul. 250.

Storage Period After Curing:—As soon as the potatoes have been cured the temperature should be reduced to 55 degrees Fahr. and kept as nearly at that point as possible. This is accomplished by the proper handling of the ventilators and windows. It is usually quite easy to keep this type of house cool and dry. During a clear and dry day with the outside temperature registering from 55 to 60 degrees, all ventilators should be opened so that plenty of fresh air can circulate through the house. Whenever the weather is rainy or the air is damp it is necessary to keep the house well closed so as not to let in any outside air.

The flue ventilators should always be kept open except during cold or wet weather, as thereby a constant circulation of air will be maintained in the house.

It is important to have the flue ventilators and the ventilators under the stove open whenever a fire is required in the stove except during very cold weather when all ventilators should be kept closed.

In case weather conditions are such in the fall that it is hard to

keep the temperature down to 55 degrees, the house can be opened during a part of the night, especially on dry clear nights, but of course this should not be done during damp weather. The manager of the house should have no trouble in keeping the house dry and cool if he uses good judgment in handling the ventilators.

The reading of the hygrometers in the house and outdoors is a good guide as to whether or not to open the ventilators. The house should be kept closed whenever the hygrometers indicate a greater humidity on the outside than on the inside. The temperature of the house should never be allowed to go below 45 degrees. During cold weather if the house seems rather moist as indicated by the reading of the hygrometer, one can easily drive off this moisture by starting a fire in the stove, being careful, however, not to let the temperature rise above 60 degrees.

DISEASE CONTROL.

It has been previously stated that the storage problem is mainly one of keeping down diseases. The importance of this fact cannot be overestimated. There are two diseases in particular, viz; black rot and soft rot, which have to be watched and kept under control in order to make sweet potato storage successful. According to our data black rot has been the cause of most of the losses in storage houses and since there is a good field remedy for this pest it certainly behooves every sweet potato grower to keep it under control by careful seed treatment and rotation of crops.

Soft rot is almost wholly a storage trouble and is usually found in improperly constructed and poorly managed houses and where potatoes are bruised by rough handling or where they were frost bitten. Both of these diseases are described on another page.

Seed Treatment:—Since black rot which is doing so much damage nearly always starts in the seed bed from diseased seed potatoes, from which it is transmitted to the slips and thence to the field, and from there to the storage house it is very important that the potatoes be carefully selected and treated at bedding time as follows:

Every potato that shows any black spots or other signs of disease should be discarded and the sound ones dipped for ten to fifteen minutes in a solution containing one ounce of corrosive sublimate to eight gallons of water. As the chemical is not quickly soluble it is best to dissolve it in warm water or in cold water over night. This solution will kill the disease germs on the surface of the potatoes but cannot reach those which have already gone through the skin, hence it is important to select the potatoes carefully before they are dipped.

*(1) A bushel of sweet potatoes, when treated in 32 gallons of a 1 to 1,000 mercuric-chlorid solution in the manner generally followed by farmers, reduces the strength of the solution approximately 1 per cent.

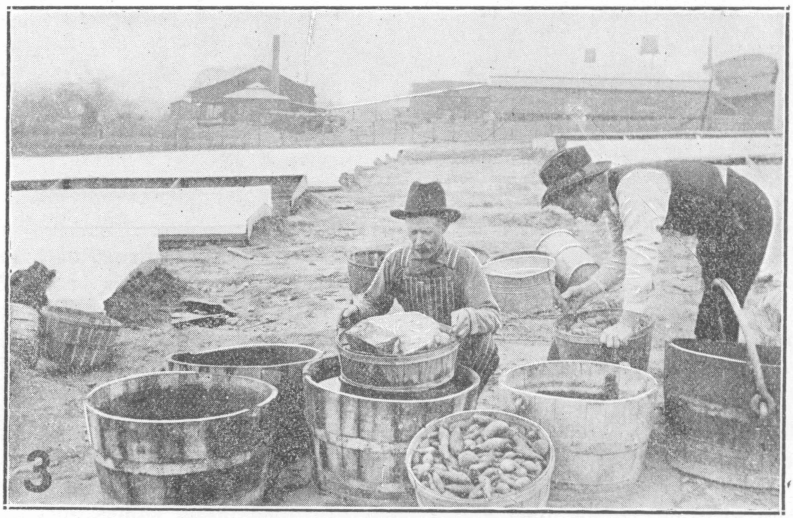
*(2) The decrease in the strength of the mercuric-chlorid solution is due in part to the potatoes themselves.

*J. L. Weimer, Journal of Agr. Research, Vol. XXI, No. 8.

*(3) The dirt and fibrous roots as well as the containers of both the potatoes and the solution also remove a certain amount of the disinfectant.

*(4) Washed sweet potatoes and Irish potatoes remove approximately the same amount of mercuric-chlorid from the solution.

*(5) The addition of from 2-5 to 1-2 ounce of mercuric-chlorid and sufficient water to make the solution up to its original volume after each 10 bushels of sweet potatoes treated will maintain the solution near enough



Figs. 4 and 5. Upper picture shows good method for treating seed sweet potatoes in corrosive sublimate solution. Lower picture shows same treatment in a specially prepared vat. (Texas Exp. Sta. Bul. 249).

to its original strength for all practical purposes for the treatment of 50 bushels of sweet potatoes.

The dipping can be easily done in a shallow vat or in barrels or half barrels. Wooden vessels should be used as the chemical is corrosive to metal. This solution is poisonous and should not be left where livestock or children can have access to it.

A handy way to do this dipping is to place the potatoes in bushel baskets or hampers and then immerse them in the solution for ten to fifteen minutes. They are ready to be placed directly in the seed bed as soon as the solution has drained off. While these are being bedded another lot can be dipped. New seed beds should also be used each year.

This method is very simple and is extremely important in keeping down serious diseases which are threatening the industry. All growers of slips whether for home use or commercial purposes, are urged to follow these directions.

In buying slips it is important to get them from reliable growers who will guarantee that their seed potatoes were carefully selected and disinfected against diseases.

Soft Rot:—This disease is well known to the farmers who store sweet potatoes. It is generally known as mush rot, vinegar rot or leak. As its name indicates, it cannot be mistaken for any other disease. Rotted potatoes become soft and mushy and at the least touch of the finger or from pressure, break open and a clear brownish liquid comes out. A few days afterward there will be noticed in the house numerous small gnats. They are merely little flies that lay their eggs in the rotted potatoes. Some people believe that these gnats are the cause of the rot but they are only an indication of the presence of soft rot in the house. Frequently also the potatoes in the bin appear wet as though water had been poured on them. This too is an indication that in that vicinity there are one or more soft rotted potatoes which have broken open and spilled their juice on the healthy potatoes underneath and also become covered with a whiskered growth of causal fungus. If a soft rotted potato remains in the bin untouched until the end of the storage season, it will usually lose all its moisture and become very hard in which case the term dry rot is often applied to it. In fact many growers mistakenly believe that this dry rot has no connection with the soft rot, but as already stated, this is the final stage of the disease. Usually a house full of potatoes that smell of vinegar indicates the presence of considerable soft rot. This condition may be met with in houses which lack the necessary means of ventilation, in which case it is not uncommon to find the moisture actually dripping from the inside walls of the house. Such houses can of course be corrected by the installation of more doors, windows and ventilators. The cause of soft rot is a fungus. It is the ordinary bread mold fungus which is often found growing on bread when kept in a tightly closed vessel. This same fungus also causes a soft rot of the Irish potato. The spores which are very small and from which the fungus grows, floats in the air or clings to the dust that is

brought in with the potatoes from the field. As long as the potato house is kept perfectly dry and properly ventilated these spores will not germinate just as seed of higher plants will lie dormant in a dry soil. As soon as the air in the house becomes heavily laden with moisture and this air is permitted to remain in the house for any length of time the spores will germinate, penetrate the sweet potato and produce the mush rot. Bruised or cut potatoes will naturally rot quicker than the sound ones for cuts present an ideal opening for these germinated spores to penetrate. As a matter of fact, mush rot or soft rot is seldom found in properly ventilated houses and where care and attention is given to the house. On the other hand, where a high percentage of soft rot is met with it may be taken for granted that either badly bruised or frozen potatoes have been put in the house or that the house was overheated or not ventilated sufficiently. While soft rot is an important disease in the potato house, it can be readily controlled by bringing in well handled potatoes and by giving due attention to the heating and ventilation.

The spores of soft rot are found everywhere in the air and the dust and do not necessarily have to be brought in from the field although they are met with there.

Black Rot:—Black rot is primarily a field trouble and when found in storage is always traceable to diseased potatoes in the seed bed or to disease infected soil in the field. It is possible under careful management to keep down the spread of this trouble to a minimum. Overheating in storage will nearly always encourage the spread of disease if infected potatoes have been brought in from the field. Usually black rot will not spread in the house as long as the skin of the potato covering the black spot is unbroken. However, as soon as the skin ruptures, there immediately develops the fruiting stage of the fungus. Under sufficient heat and moisture these spores will ooze out in little yellowish droplets on the surface of the potato. The numerous mites usually present in the house are very fond of and will come to feed on this yellowish fluid which contains the spore seed of the fungus. In feeding, their bodies become smeared with the black rot spores which they carry about and spread from potato to potato. It is possible to manage the house so as not only to minimize the spreading of the spots on the potatoes already affected but also to prevent the cracking of the skin and development of this fruiting stage.

Black rot itself is only a skin deep disease. However, its presence is very detrimental to the potato as it leaves a decidedly bitter quinine-like taste and makes the potatoes when cooked unfit for eating purposes. Besides, black rot opens the way to soft rot as it lowers the disease-resisting power of the potato.

Black rot in the house may be controlled by giving due attention to the temperature; by seeing that during the curing period the temperature never rises above 80 degrees; and after curing by maintaining a temperature of about 55 degrees Fahr.

Moreover, if the crop is grown on uninfected soil, and carefully selected and treated seed are used, there should be little damage from black rot.

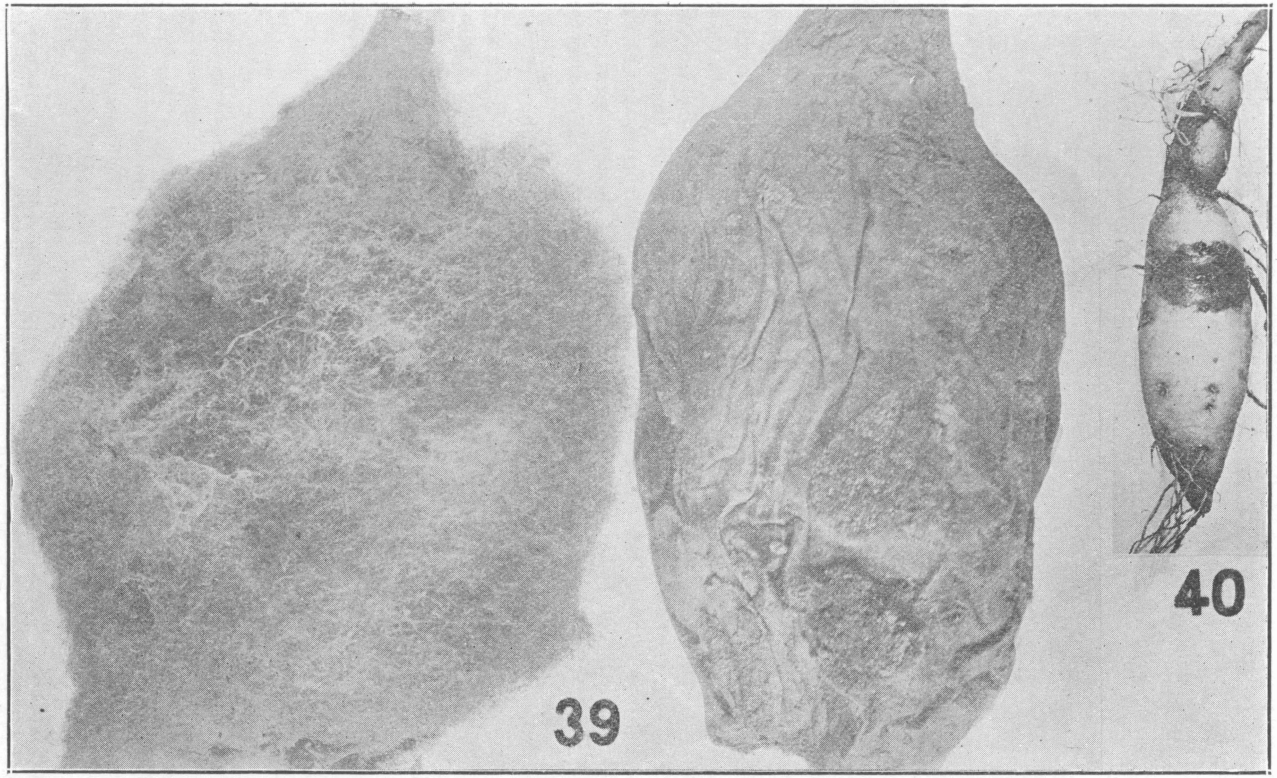


Fig. 6. The two large potatoes on the left show two stages of soft rot. The small potato on the right is infected with the black rot. (Texas Exp. Sta. Bul 250).

There are, of course numerous other diseases which may attack the sweet potato in storage but usually those are secondary and follow in the wake of either black rot or soft rot and because they are not sufficiently important they are here omitted.

The managers of potato houses should be cautioned never to go through the bin with the view of sorting out bad potatoes. They will scatter spores of disease producing fungi and hence will do more harm than good. It is much better not to handle them until they are ready for shipping.

THE BUSINESS SIDE OF POTATO HOUSES.

The first year of the operation of a storage house is the most critical year. There are several reasons for this: (1) The community is liable not to produce enough potatoes to fill the house and this is especially true if the house is of large capacity. It is therefore well to begin with a small house and addanot herunit from year to year as potato growing increases in popularity with the farmers.

(2) Farmers must become accustomed to handling potatoes without bruising, as bruised potatoes are hard to keep and unfit for market.

(3) The manager not being able to fill the house with carefully handled potatoes, will be tempted to accept inferior potatoes and thus add to the difficulties of keeping down rot.

The manager himself will present a problem. The business of storage will be new to him. If the owner of the house is in immediate charge, or if a thoroughly capable man is hired, the business will be quickly mastered, but if an indifferent man is hired, the losses may be large. Enough wages should be paid to hire a good man and to cause him to take a real interest in the problems of storage.

As the storage period runs only about six months, the manager may be profitably employed in growing slips for sale. This is desirable for three reasons: (1) it will add to the income of the house and help to pay the manager; (2) if the slips are properly grown it will supply the farmers with plants free from diseases and will thus cut down losses during the next storage season, and (3) it would standardize the potatoes grown in the community and sold through the house.

REGRADING AND SHIPPING.

Before being shipped, the potatoes should be carefully re-graded into the standard grades and all those that do not come up to the required specifications, should be discarded. There is nothing more important in successful marketing than to ship carefully packed and graded products such as the market wants, thereby getting the top prices and establishing a reputation which will bring repeat orders. Consumers are willing to pay a good deal more for nice looking products than for inferior stuff, which is high at any price. Poorly graded products are not wanted by the buyers and it is poor policy to ship them. It is much more profitable to feed these inferior potatoes to the hogs than to at-

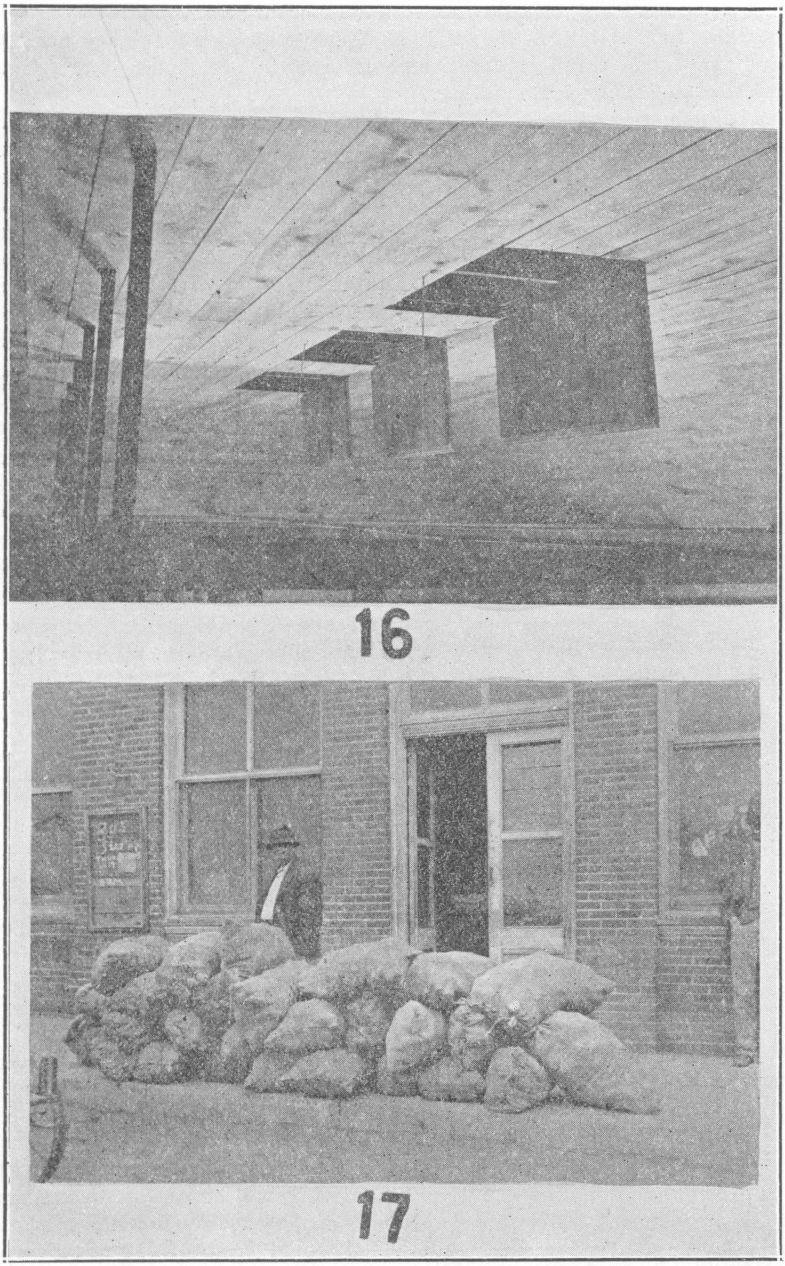


Fig. 7. Upper picture shows ceiling door vents. Lower picture shows sweet potatoes, packed in sacks for shipment, a practice which is highly injurious to the potatoes, as they become skinned and bruised, causing rot and unsightly appearance. (Texas Exp. Sta. Bul 250).

tempt to sell them. Bushel crates are good containers to use for shipping sweet potatoes. They should never be shipped in sacks.

Care In Shipping:—Sometimes after potatoes have been perfectly cured they spoil while in the car or after they have reached the jobber on account of improper handling.

Cars should not be loaded during cold or wet weather if possible, and for long shipments during cold weather it is sometimes necessary to provide artificial heat in the car to prevent chilling. Cars should be kept dry and cool on the inside while they are conveying the potatoes to market. The jobber who receives potatoes should store them in a room that may be kept as dry and as near a temperature of 55 degrees as possible. The retailer and consumer should store them with care for the best results. It should always be remembered that even cured potatoes are liable to rot when improperly handled after being taken out of the house.

UNITED STATES AND TEXAS GRADES FOR SWEET POTATOES.

Grade No. 1 shall consist of sound sweet potatoes of similar varietal characteristics which are practically free from dirt or other foreign matter, frost injury, decay, bruises, cuts, scars, cracks, and damage caused by heat, disease, insects (including weevils), or mechanical or other means.

The diameter of each sweet potato shall not be less than one and three quarter (1 3-4) inches nor more than three and one-half (3 1-2) inches and the length shall not be less than four inches nor more than ten inches but the length may be less than four inches if the diameter is two and one quarter inches or more.

Grade No. 2 shall consist of sound sweet potatoes of similar varietal characteristics not meeting the requirements of the foregoing grades which are free from serious damage caused by dirt or other foreign matter, frost, injury, decay, bruises, cuts, scars, cracks, heat, disease, insects, or mechanical or other means, and which are not less than one and one half inches nor more than three and one half inches in diameter.

Jumbo Grade shall consist of sound sweet potatoes of similar varietal characteristics, which are free from serious damage caused by dirt or other foreign matter, frost, injury, decay, bruises, cuts, scars, cracks, heat, disease, insects, or mechanical or other means and which are not less than three and one half inches in diameter.

In order to allow for variations in these grades, incidental to commercial grading and handling, five per cent by weight of any lot may be less than the diameter prescribed and in addition, six per cent by weight may be below the remaining requirements of this grade.

DEFINITION OF GRADE TERMS AS USED IN THESE GRADES.

"Practically free" means that the appearance shall not be injured to an extent readily apparent upon casual examination of the lot and that any damage from the causes mentioned can be removed without appreciable increase in waste over that which would occur if the sweet potatoes were perfect.

"Diameter" means the greatest dimension at right angles to any

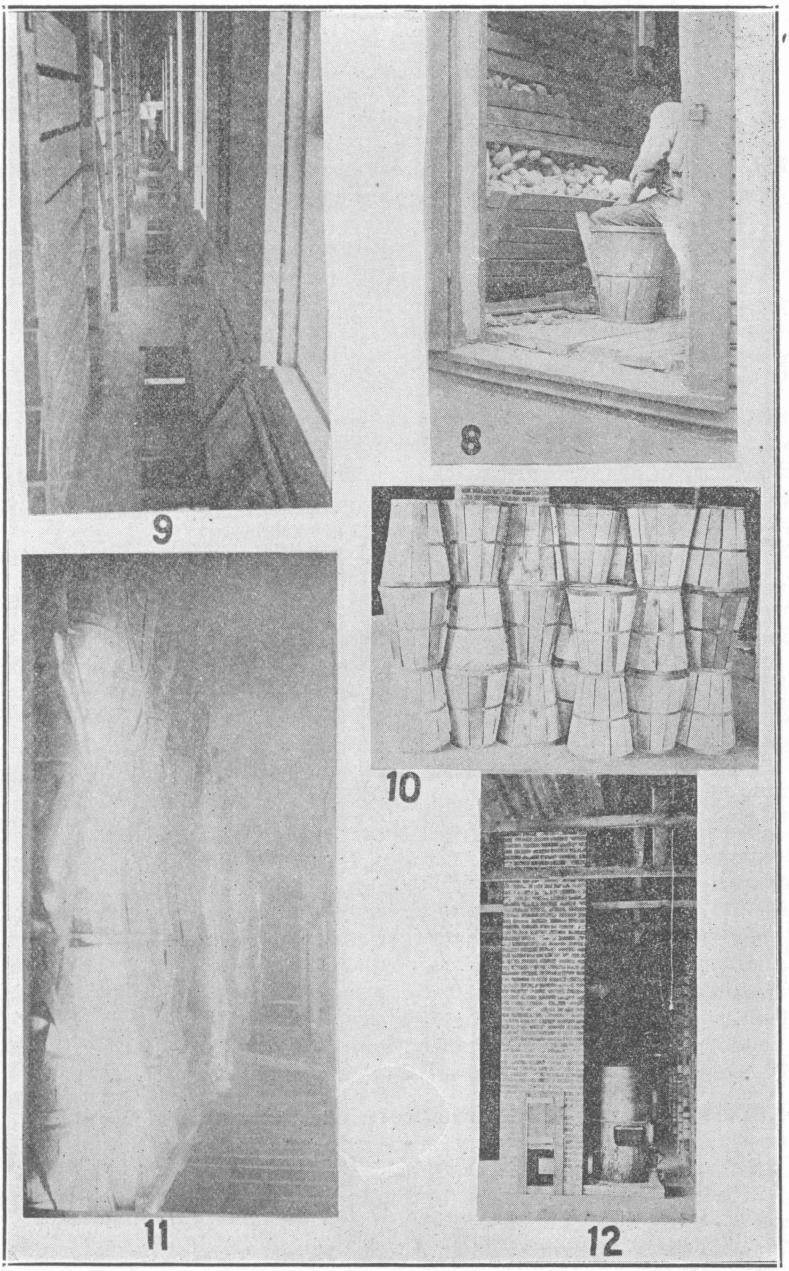


Fig. 8. Cut 8 shows convenient method of taking potatoes from bins. Cut 9 shows floor vents behind bins or crates. Cuts 10 and 11 show proper method of stacking hampers. (Crates are better for storing and shipping sweet potatoes than hampers). Cut 12 shows school house heater and brick flue.

portion of a central line running through the sweet potato from stem end to root end.

"Free from Serious Damage" means that any damage from the causes mentioned can be removed without increase in waste of more than ten percent by weight over that which would occur if the sweet potatoes were perfect.

BILL OF MATERIALS FOR 26 BY 60 FOOT TEXAS A. AND M. SWEET POTATO HOUSE—ABOUT 5,000 BUSHELS CAPACITY.

Concrete for Piers, Footings, etc. (Mixture 1:2 1-2:5):
Cement—100 sacks.
Sand—9 cu. yards.
Gravel—18 cu. yards.

Brick for flue.—1000.

Mortar for flue (Mixture 1:3):
Cement—6 sacks.
Sand—1 cu. yard.

Terra Cotta Flue Lining.—12"x12," 24'.

		Board ft.
Girders:	2—8"x10"x18'	240
	6—8"x10"x14'	560
Sills	24—2"x 6"x12'	288
	4—2"x 6"x14'	56
Joists	89—2"x10"x18'	2670
Studs	105—2"x 4"x12'	840
Cupola Studs	14—2"x 4"x14'	93
Plates	24—2"x 4"x12'	192
	4—2"x 4"x14'	37
Cupola Plates	5—2"x 4"x16'	53
Ties	24—2"x 4"x14'	224
Stop (between studs at floor)	14—2"x 4"x12'	112
Ceiling joists	31—2"x 4"x16'	331
Window headers and sub-sills	6—2"x 4"x12'	48
Headers around vents	12—2"x 4"x16'	128
Stops between rafters	10—2"x 6"x12'	120
Rafters	66—2"x 6"x18'	1188
Cupola rafters	11—2"x 4"x14'	103
Frames (foundation doors)	6—2"x 8"x12'	96
	6—1"x 4"x16'	32
Ridge board	3—1"x 6"x20'	30

		Board ft.
Bridging	28—1"x 3"x10'	70
Floor (Shiplap)		3500
Ceiling (Shiplap)		3700
Walls—Inside (Shiplap)		4800
Walls—Outside (Shiplap)		3200
Roof (Shiplap)		2600
Drop Siding		2800
Shingles	17,500	

Cupola:

Vent sills	4—2"x8"x16'	85
Vent frames	10—1"x4"x16'	53
Louvers	32—1"x8"x16'	384
Corner boards	4—1"x4"x16'	21
	8—1"x5"x14'	56
Ridge boards	6—1"x6"x18'	54
	2—1"x6"x12'	12
Fascia boards	6—1"x6"x16'	48
Platforms	2—4"x 4"x10'	27
	5—2"x 8"x16'	107
	4—2"x 4"x16'	43
	4—2"x 6"x14'	28
	10—2"x10"x16'	267
	4—2"x12"x12'	96

Window Frames—10 frames, complete with casings, for 8 light, 2 sash windows, 12"x14" glass, without pulley or weights.

2 frames, for gable sashes, 4 light, 12"x14" glass.

Window Sash.—Sashes for 10 double sash windows, 8 light, 12"x14" glass.

Gable Sash.—2 single sashes, 4 light, 12"x14" glass.

Door Frames.—2 frames, complete with casings, for 3'x7' doors.

One heating stove—jacketed—complete with metal vent doors.

Hinges—2 prs.—8" strap hinges.
Hinges—20 prs.—6" strap hinges.
28 prs.—6" T hinges.
Canvas—10oz. material—55 sq. yds.
Nails—500 pounds.
Screen wire for floor and foundation doors, 1-4" mesh, 200 sq. ft.
Building paper—1,000 sq. yds. Pulleys for 1-4" rope—6.
Rope—1-4"—85'. Bolts—18—1-2"x12" and 16 1-4"x5".
Strap iron—8 pieces 1-4"x2"x16".
Flashing—60 linear feet, tin, 7" wide.
Paint.—2 coats outside, 12 gallons.

MATERIAL FOR BINS (ONLY).

		Board ft.
Bin Floor Joists (lower)	60—2"x8"x 9'	720
Bin Floor Joists (upper)	50—2"x6"x10'	500
Studs	115—2"x4"x12'	920
Plates (over bins)	20—2"x4"x10'	134
Spacers	40—2"x4"x10'	268

		Board ft.
Cleats	103—1"x2"x10'	172
	29—1"x6"x14'	203
Slats	270—1"x4"x10'	900
	1000—1"x4"x 9'	3000
Bridging	30—1"x3"x10'	75
Floors	430—1"x4"x 9'	1290
Slats (loose)	94—1"x6"x10'	470

Nails —200 pounds.
Hinges—6" strap hinges—60 prs.

Material for Storage in Crates, Hampers, or Baskets without Bins.

		Board ft
Studs	40—2"x4"x12'	320
Floor rack or Platform	60—2"x8"x 9'	720
	210—1"x4"x10'	700
	30—1"x3"x10'	75

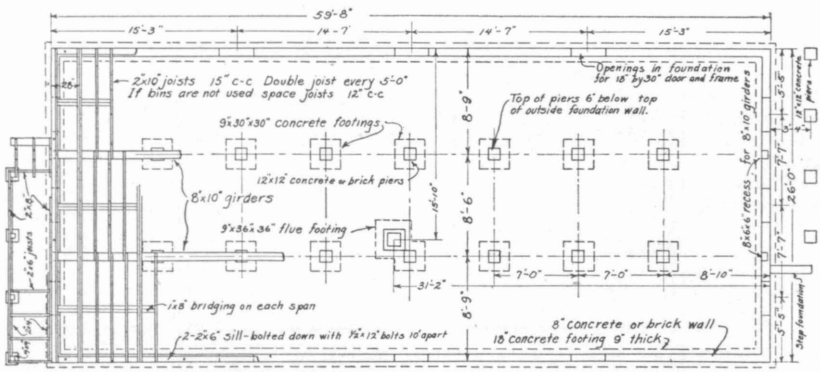


Fig. 9. Foundation plan of 26x60 foot sweet potato storage house.

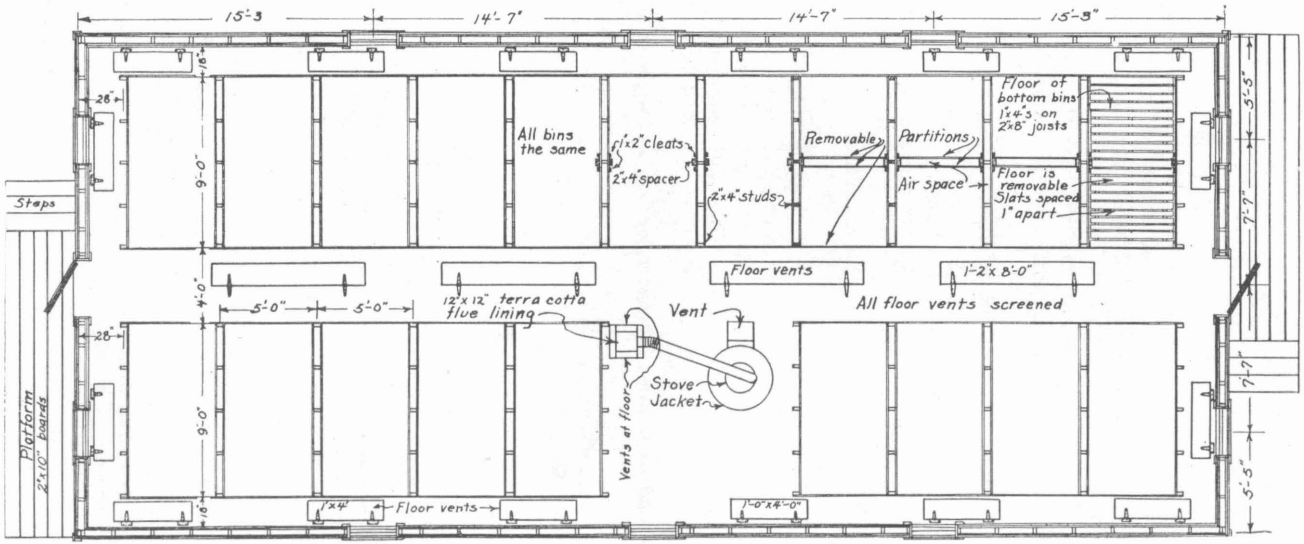


Fig. 10. Floor plan of 26x60 foot sweet Potato House. Capacity about 5,000 bushels.

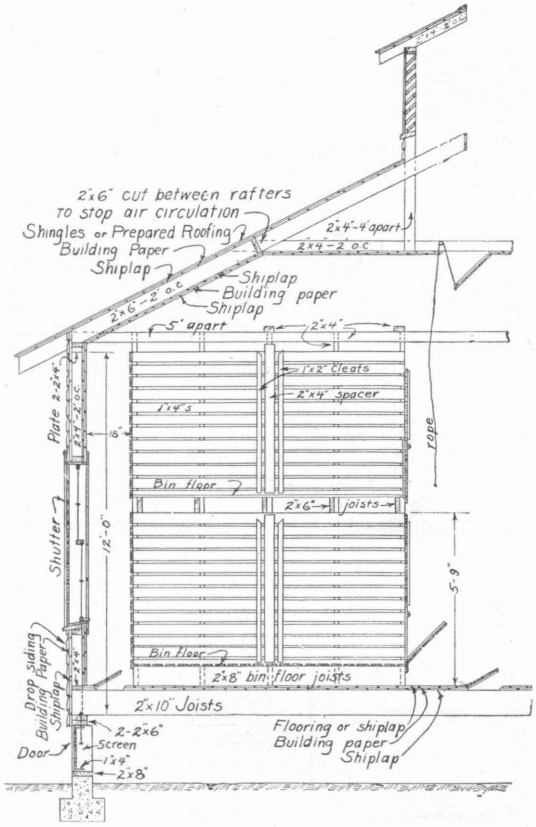


Fig 11. Section of 26x60 foot house.

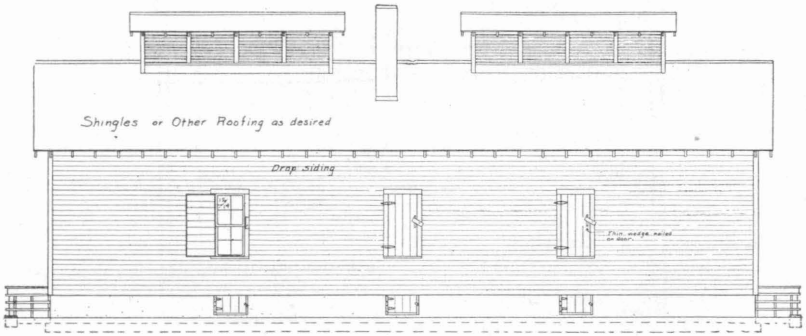


Fig. 12. Side view of 26x60 foot house.

Fig. 13. End view of 26x60 foot house.

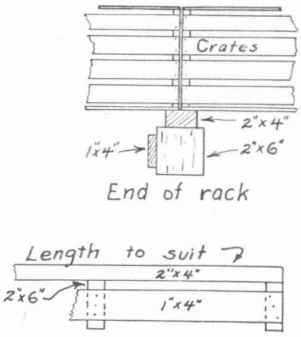


Fig 15. Crate rack for supporting sweet potato crates a few inches off the floor where bins are not used.

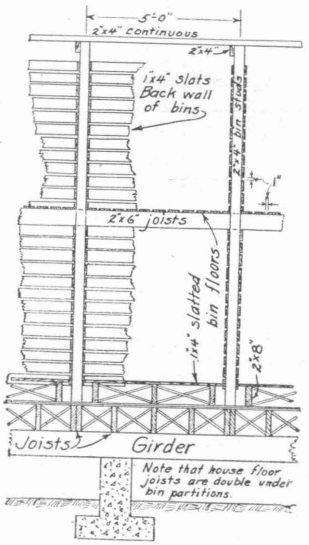


Fig. 14. Section of a storage bin.

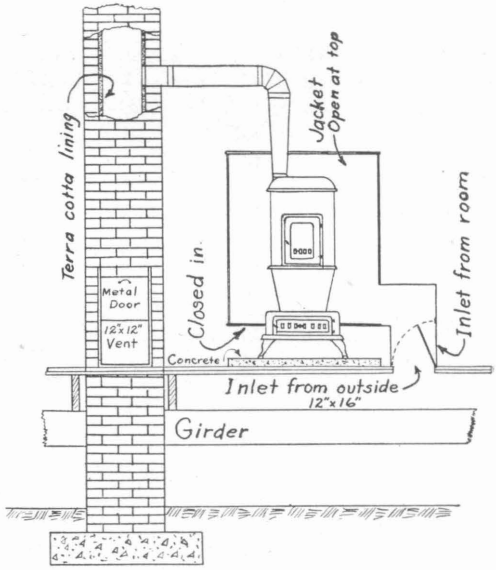


Fig. 16. Jacketed stove for use in sweet potato storage houses.

BILL OF MATERIALS FOR 40 BY 100 FOOT TEXAS A. AND M. SWEET POTATO STORAGE HOUSE—ABOUT 15,000 BUSHELS CAPACITY.

Concrete for wall, piers and footings (mixture 1:2 1-2:5):
- Cement—175 sacks
- Sand—16 cu. yds.
- Gravel—32 cu. yds.

Flues—3100 bricks

Flue Mortar (Mixture (1:3)—
- Cement—16 sacks.
- Sand—2 cu. yds.

Flue lining—terra cotta.—12" x12" —66 ft.

Thimbles.—3—6"

		Board ft.
Girders	6—8"x10"x10'	400
	15—8"x10"x16'	1600
Sills	35—2"x 8"x16'	747
Studs	164—2"x 6"x12'	1968
	14—2"x 6"x14'	196
Headers and sub sills at windows	8—2"x 6"x16'	128
Plates	35—2"x 6"x16'	560
Ties	6—2"x 6"x18'	108
	12—2"x 6"x12'	144
Posts	12—4"x 6"x18'	432
Purlins	18—2"x 8"x12'	288
	18—2"x 6"x12'	216
Braces under purlin	18—2"x 6"x14'	252
Rafters	106—2"x 6"x14'	1484
	106—2"x 6"x12'	1272
Collar ties	13—1"x 6"x16'	104
Joists	101—2"x10"x18'	3030
	202—2"x10"x12'	4040
Cupolas		
Studs	24—2"x 4"x16'	256
Plates	6—2"x 4"x20'	80
Rafters	20—2"x 4"x14'	187
Louver sills	6—2"x 6"x20'	120
Frames	30—1"x 4"x10'	100
Louver boards	60—1"x 8"x16'	640
Trim	17—1"x 4"x12'	68
Platforms and Steps		
Posts	1—4"x 4"x16'	21
	1—6"x 6"x12'	36
Floors	20—2"x10"x14'	467
Joists	4—2"x 8"x14'	75
	4—2"x 8"x12'	64
	9—2"x 8"x16'	192
	3—2"x 6"x16'	48
	4—2"x 4"x12'	32
	4—2"x 4"x14'	37
	10—2"x12"x12'	240
Bridging	1"x3"	250
Wall stop between studs at floor	20—2"x6"x14'	280
Stop between rafters in roof	12—2"x6"x16'	192
Ceiling joists	51—2"x6"x20'	1020
Headers around vents	36—2"x4"x16'	384
Partition		
Studs	4—2"x4"x12'	32
	8—2"x4"x14'	75
	8—2"x4"x16'	85
	22—2"x4"x18'	264
Partition plates and sills	4—2"x4"x12'	32
	6—2"x4"x18'	72
Door frames in Foundation	7—2"x6"x18'	168
	10—1"x4"x18'	60
Office Framing		
Studs	4—2"x4"x16'	43
	4—2"x4"x12'	32
	4—2"x4"x10'	27
Rafters	8—2"x4"x10'	54
Plates	2—2"x4"x16'	21
	3—2"x4"x10'	20

Shiplap

Floors	9600
Inside walls	11200
Ceiling	9800
Outside walls	5000
Roof	6500
Drop siding	5100
Corner boards	8—1"x5"x14' 56 4—1"x5"x 9' 18
Fascia boards	26—1"x6"x12' 156
Roof Ridge-boards	4—1"x6"x14' 28 10—1"x6"x10' 50 6—1"x6"x12' 36
Shingles	43,000.

Window frames—17 frames, complete with casings, for 2 sash, 8 light windows, glass, 12"x14", sashes movable, but without pulleys and weights. Two frames, with casings, for gable sash, 4 light sash, glass 12"x14", not movable.

Sashes—For 17 double sash windows, and 2 single sash windows, all 4 light 12"x14" glass.

Door Frames.—Eight frames complete with casings for 3'x7' outside doors, 6" studs, 3 frames complete with casings for 3'x7' stock doors, 4" studs.

Doors—3 stock doors with locks and hinges.

Latches—For all outside doors and window shutters.

Building paper—2500 sq. yds.
Canvas (10 oz.) 150 sq. yds.
Rope—290 ft. 1-4" rope.
Hinges—45 prs. 6" strap hinges.
70 prs.—6" T hinges.
8 prs.—8" strap hinges.
Pulleys—18 for 1-4" rope.
Screen wire—550 sq. ft. 1-4" mesh.
Flashing—150 linear ft. of tin 7" wide.
Strap iron—11—1-4"x2"x16'.
Bolts—12—1-4"x5".
10—1-4"x7."
28—1-2"x12".
Nails 1300 pounds.

Stoves—3 jacketed stoves complete with metal vent doors.
Paint—2 coats outside, 22 gallons.

Crate Racks:

		Board ft.
For blocks—	102—2"x4"x16'	1088
	18—2"x4"x10'	120
	32—2"x6"x16'	512

	Board ft.
102—1"x4"x16'	544
18—1"x4"x10'	60

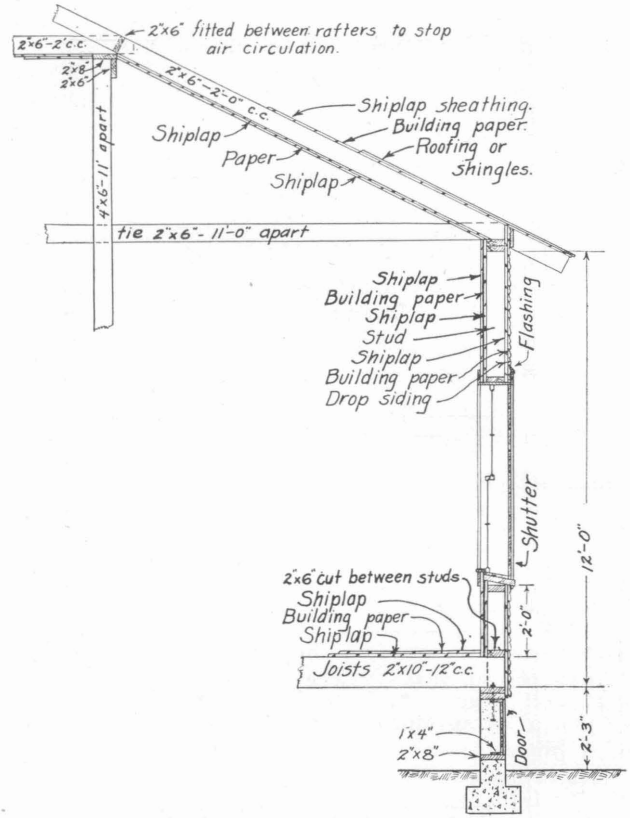


Fig. 19. Part section of 40x100 foot house.

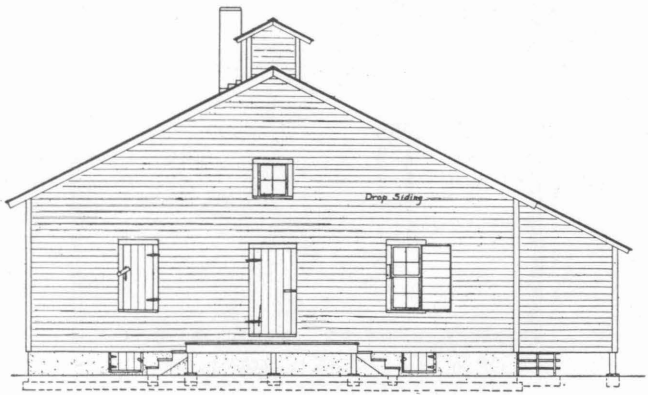


Fig. 21. End elevation of 40x100 foot house.

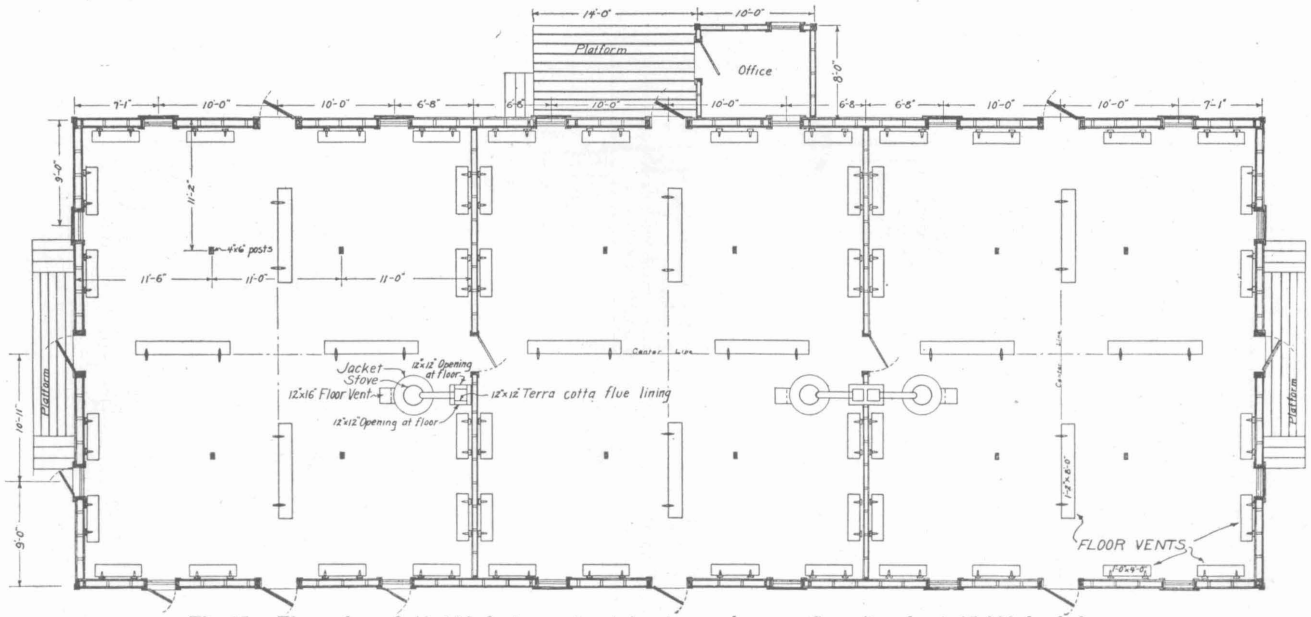


Fig 17. Floor plan of 40x100 foot sweet potato storage house. Capacity about 15,000 bushels.

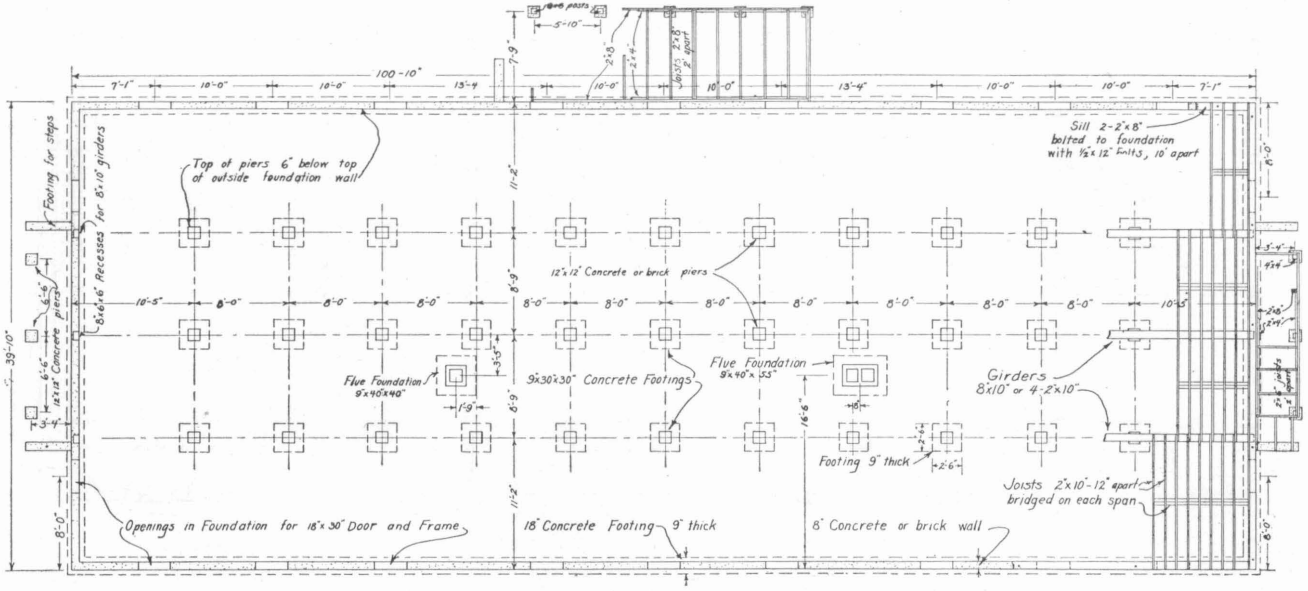
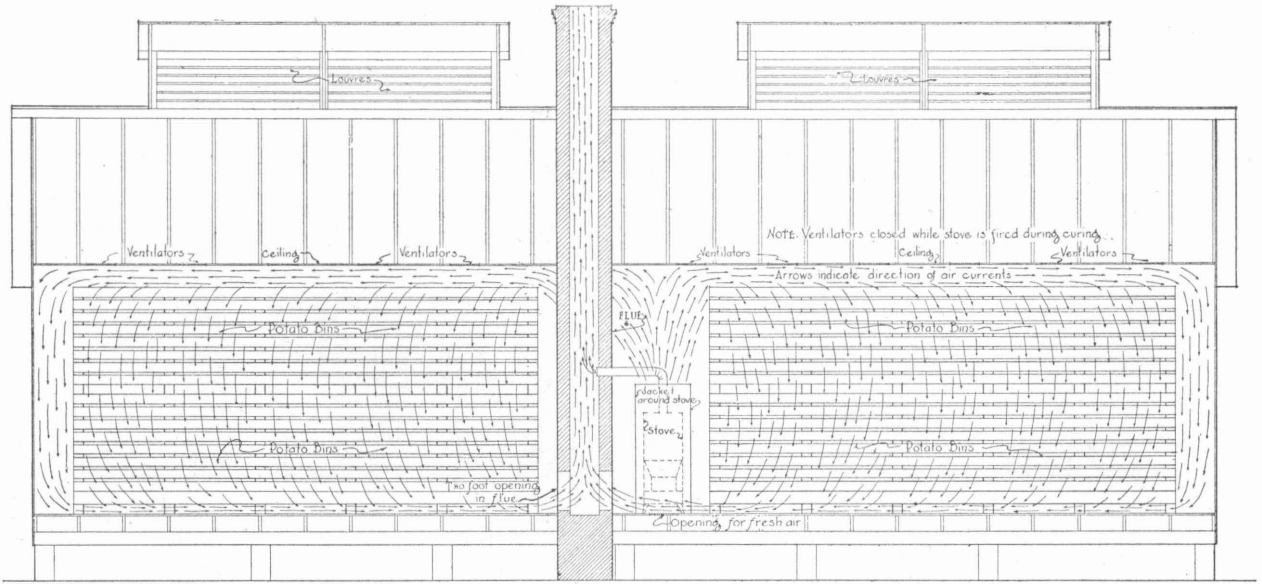


Fig. 18. Foundation plan of 40x100 foot house.

Fig. 20. Side Elevation of 40x100 foot house.



DIAGRAMATIC SKETCH SHOWING CIRCULATION OF HEATED AIR AROUND BINS IN SWEET POTATO HOUSE

Fig. 22. Diagram sketch showing circulation of heated air in A. and M. type of sweet potato storage house.

SUMMARY OF IMPORTANT POINTS.

1. The success of sweet potato storage begins in the seed bed.
2. Carefully select seed potatoes before bedding; discard all those that show signs of diseases, and then dip the healthy ones for 10 to 15 minutes in a solution containing one ounce of corrosive sublimate to eight gallons of water, in order to prevent diseases.
3. Harvest sweet potatoes before frost and handle them very carefully to prevent bruising, as bruised potatoes are hard to keep and are unfit for market. Never allow the potatoes to become chilled.
4. In case of a killing frost before harvesting cut the vines at once, and then dig the potatoes as soon as the weather permits.
5. Always place the potatoes from the furrows directly into the crates or baskets without dropping them.
6. Thoroughly clean out and then disinfect the storage house before storing the potatoes by spraying with a solution containing 5 pounds of bluestone to 50 gallons of water.
7. Store potatoes in a well constructed storage house, either in crates or bins, the crates being preferable.
8. Cure the potatoes for about two weeks at a uniform temperature of 75 to 80 degrees.
9. When sufficiently cured as indicated by a leathery or velvety skin, or by small sprouts appearing, the fire should be stopped and the temperature reduced to about 55 degrees by opening the ventilators.
10. After curing, the temperature should be kept as nearly as possible between 50 and 60 degrees and the humidity between 40 and 65, the latter being indicated by the hygrometer.
11. All ventilators should be opened whenever the temperature and moisture conditions are more favorable on the outside than in the house as shown by the thermometers and hygrometer.
12. If the house becomes damp in cool and wet or damp weather, a slow fire should be kept going until all dampness has been driven out.
13. Never go through the bins or crates with the view of taking out diseased of rotten potatoes because more harm than good will be done.
14. Let one reliable person have entire charge of the house and be responsible for its proper operation.
15. When shipping, carefully regrade and pack the potatoes and ship only a well graded product, thereby establishing a reputation which brings repeat orders.