AGRICULTURAL ENGINEERING
By C. L. Zink, B.S.
Agricultural Advancement An Engineering Problem; High Power
Machinery for Low Cost Production; Future Bright for the
Agricultural Engineer

To MANY PERSONS the term, agricultural engineering, is an
unfamiliar one. They think of an engineer as the man who operates en-
gines or perhaps the surveyor with his transit and chain. Both of these
are members of long established branches, mechanical and civil engi-
neering. However, there are other divisions of engineering, the electrical,
chemical, structural and mining, as well as the agricultural, with which
we are now most concerned.

"Engineering is the art and science of organizing and directing men and
controlling forces and materials of nature for the benefit of the human
race." "Agriculture is the industry concerned with the production of raw
materials for food, clothing and shelter." Agricultural engineering, then
applies the principles of engineering to the furtherance of agriculture.

The purpose of agricultural engineering is well expressed by the Ame-
erican Society of Agricultural Engi-
neers, a technical organization of high
ideas, in stating their aims and ob-
jectives as follows: "To develop indi-
vidual and group leadership based on
higher efficiency, greater productive
capacity and better operating practices
among those engaged in the produc-
tion of raw materials for food, shel-
ter and clothing, through the applica-
tion and use of engineering principles
in the industry of agriculture. The
aim of this objective is directed toward
creating a desire for, and the capacity
to enjoy, higher standards of living,
better working conditions, adequate
educational facilities and equitable so-
cial progress for those engaged in the
agricultural industry."

America dominates the agricultural
world purely because the engineer has
given her the equipment to do so.
Agriculture plodded along for centur-
ies with the sickle, the flail, and the
crooked stick as her implements of
production, and it is only within the
last one hundred years that hand labor
has been replaced by machinery. Sec-
retary W. M. Jardine stated in an
adress at New York City, "The most
impressive development of all time in
agriculture has been the advent of
modern farm machinery. Could the
farmer of Pharaoh's time have been
suddenly reincarnated and set down in
our grandfather's wheat field, he could
have picked up the grain cradle and
gone to work with a familiar tool at a
perfectly familiar job. And then, with-
in the space of twenty years, the
methods of crop production underwent
greater changes than they had in the
previous 5,000 years. At one stride
we covered ground where fifty centur-
ies had left almost no mark of prog-
ress whatever."

Between the years 1850 and 1925, the
steel plow, the threshing machine, the
binding machine, the mower, and the
reaper came into use and, according to
the twelfth census report the year
1850 marks the end of the hand age.
This is truly an era of machine pro-
duction. The manufacturing industry,
however, directed by engineers, has
advanced farther than has agriculture.
Under present average conditions the
farmer must work over two and one-
half hours to produce that which will
purchase the result of one hour of the
industrial worker's labor. This unbal-
anced economic condition must be rem-
edied before those engaged in agricul-
tural pursuits may attain the stand-
ards of living enjoyed by those em-
ployed in industry. Well informed
men in all circles know that the pro-
duction costs per unit on American
farmers must come down. The farmer
can no longer depend upon prices
alone, over which he has little or no
control, to yield a profit.

There must be smaller expense in
raising a bushel of corn or a ton of
hay. Serious competition in this coun-
try is eminent, particularly between
producers of wheat, cotton, and dairy
products. The most serious competi-
tion is in the world markets. This can
be successfully met only by lower
costs.

The cost of producing a crop may
properly be divided into power, labor,
use of land, fertilizer and seed. Of
these, the last three are for the most
part fixed. The remaining two, power
and labor, make up 40 to 85 per cent
of the production cost of corn, wheat,
oats and cotton, according to data se-
cured by the U.S.D.A. Bureau of Ag-
ricultural Economics, and state agri-
cultural colleges and experiment sta-
tions. These costs can and are being
reduced by time saving machinery and
methods. G. W. McCuen, professor
of agricultural engineering at Ohio State
university, has for several years been
conducting an experiment on raising
a corn crop using exclusively motor
driven equipment and has found it to
be both practical and economical. He
succeeded in reducing the time neces-
sary to grow and harvest an acre of
corn from 26 to 5.77 man-hours. Many
other examples just as noteworthy may
be found where engineering has low-
ered agricultural production costs.

The individual farmer who wishes
of his profits must consider
three principal factors. They are quan-
tity, cost, and price. The price at
which he sells, less the cost of produc-

Primitive Transportation Methods, One Reason Agriculture Has Not Progressed in the Past
A Farmers' Rally Made Possible by the Automobile, a Development of Modern Engineering

A profound impression upon me that in Italy five farm workers have only one horse among them and the crop production of each worker is worth only $45 while in my native state, Nebraska, each farm worker has at his command nearly five horses with which he produces crops worth $910.

Obviously there is a tremendous advantage enjoyed by the worker who uses the most power. It is in this respect that the American industrial worker is more favorably situated than his agricultural brother. To alleviate this condition by seeking ways and means for the farmer to use more power and that more efficiently is one of the purposes of the agricultural engineer.

The field of agricultural engineering has wide limits. Some of its divisions include research, instruction and production in irrigation, drainage, flood control, reclamation and utilization of waste land, rural electrification, farm mechanics, farm machinery, farm power, rural architecture, farmstead planning, farm home utilities and sanitation.

Nebraska and Iowa pioneered in agricultural engineering instruction. In 1904, Nebraska offered secondary courses in forge work and farm machinery under Professor J. B. Davidson, now head of the Agricultural Engineering department of the Iowa State college. In 1908, Iowa offered a degree in agricultural engineering and the following year Nebraska adopted a degree course. In 1914, Professor J. B. Davidson was granted by the University of Nebraska, a professional degree in agricultural engineering, the first degree of this kind ever given anywhere. To Professor Davidson and Professor L. W. Chase, head of the agricultural engineering department of the University of Nebraska from 1905 to 1920, should go a large portion of the credit for the development of agricultural engineering.

The requirements for an agricultural engineering degree include a large amount of general engineering work. Courses in the civil, mechanical, electrical, chemical, architectural and applied mechanics departments are necessary. Preparation in physics and mathematics is the same as for other engineering degrees. The accompanying table compiled by Professor Ayres of Iowa State college shows the agricultural engineering curriculum in four outstanding universities.

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<td>62.3</td>
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Two important problems confronting the profession today are, (1) the $10,000,000 war being waged by the government against the corn borer, and (2) flood control, particularly on the Mississippi.

Sixty million acres are now infested by the corn borer, and entomologists agree that mechanical means are necessary to control it. This insect pest is the most serious that has ever faced American agriculture. It lives through the winter in the corn stalks and other coarse vegetation. When the corn is made into ensilage, the borer is destroyed. Agricultural engineers have designed equipment to pulverize the corn stubble which leaves the pest without a place of hibernation.

Regarding flood control on the Mississippi, well informed men are agreed that higher levees, reservoirs and spillways are not sufficient to control the flood waters of the Mississippi, but that an extensive program must be carried out along the head waters of the Mississippi and its tributary rivers to prevent a too rapid run-off of snow and rainfall. This will call for terracing of sloping fields, reforestation and forest fire prevention.

Terracing sloping land would in a large measure eliminate erosion. This would be of tremendous value as "investigation by federal and state agencies indicate that twenty average crops do not draw as much fertility from the soils of the United States as is lost in one year by erosion."

Founded on the most basic industry in the world, agricultural engineering offers wonderful opportunities to the (Continued on Page 16.)
THE STATE FAIR
Continued from Page 6
Livestock, exhibited at this fair, are all examples of what is possible in the way of quality production, and serve as a measuring stick to guide the farmer in his efforts to produce the best. It is true that every farmer cannot produce the best, but seeing the best will better enable him to determine just how far he is falling short and give him a new determination to strive harder to reach the goal.

The State Fair, therefore, should serve as an incentive to the farmers of the state to produce the best and it is to the accomplishment of this ideal that it should be directed.

SPECIALIZATION
Continued from Page 6.
Farm products, however, we do not wish to imply that diversification has not its value. Under the conditions generally encountered in the east at this time, it has its place, and since such is the case, it should confine itself to that region. Southwestern agriculture is particularly well adapted for specialization, and only when this is fully recognized will our agriculture assert itself and take its rightful place at the top of the ladder of prosperity and progressive agriculture.

DATE PROPAGATION
Continued from Page 7
In the growing season the offshoots should be irrigated frequently enough to keep the soil moist around the offshoot. The number of irrigations can be reduced during the winter months as long as enough water is applied to keep the soil in a good growing condition. The offshoots should be irrigated every week during the summer months after the first season.

Young palms should be wrapped with burlap during the first winter to protect them from killing frosts. The protection should be removed in the spring as soon as all danger from killing frosts has passed.

The varieties now being planted in southern Arizona are Awaydi, Deglet Noor, Halawi, Hayany, Iteena, Klahavi, Khalasa, Kustawi, Macrum, Zahi.

If the dates are set out correctly and properly cared for they can be grown almost as successful as can the more common fruit trees. The date is suitable to the warmer sections of Arizona, and, in time, should take its place among the leading commercial fruits of southern Arizona.

AGRICULTURAL ENGINEERING
Continued from Page 9
Young man with an engineering bent and an attitude sympathetic to agriculture. O. W. Sjogren, chairman, department of agricultural engineering, University of Nebraska, and past president of the American Society of Agricultural Engineers, says, "As to the future of agricultural engineering, I cannot see anything but a bright future. If agriculture is going to rise from its present disparity as compared to manufacturing and the other industries of our country, it must make a greater application of engineering. Who is to do this best but the engineer who is familiar with agricultural methods? Agriculture must adopt the methods of other industries and increase the productive power per individual engaged in that industry. The only way that this can be accomplished most effectively is by a greater adoption of engineering methods. It is true that agriculture has developed by the aid of agronomists improving grain, by the animal husbandman improving breeds of various kinds of livestock, a greater study has been made of effective applications of fertilizers and in many other ways. All these agencies need equipment of the most efficient kind, which the engineer must design and, perhaps, in many cases, operate."

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