itself. You can stand on the rim in the crater and reach the lava with a stick."

At the same time furious explosions were taking place in the higher craters. In a few days, however, the activity greatly diminished, especially at the northern end of the ridge. Lava ceased to flow from the crest, but flowed continuously, and still flows, from the low south-western craters. The extent of the new lavas on April 8 is shown on the map (in solid black).

While all activity ceased in the north-east and lava ceased to flow from the crest, violent explosions continued at the summit crater and the high-level craters of the south-western flank. In many of the explosions large blocks were thrown to a height of 500–600 m., and the detonations were so loud that it was difficult to sleep in Thòrsàdalur, 20 km. distant from the volcano. Again, at shorter distances, the same explosions did not seem to be so loud owing to some acoustical trick.

Flashing arcs of light were a common sight. Ash was only occasionally blown out in quantity and was harmless at first. Nevertheless, if it continued into the haymaking period serious effects would follow. The pumice fall in Fljòtshlidh and Eyjafjöll, however, caused the evacuation of some farms.

With the exception of the initial shock, notable earthquakes have not occurred in the vicinity of the volcano; but in the district of Ölfus very heavy shocks occurred on May 19. Hot-spring activity was greatly augmented, and every quiescent pool in a long, narrow strip of country became a violent geyser of dirty water.

In a further letter (July 17), Dr. Einarsson states that the eruption goes on. Lava still flows uninterruptedly (presumably from the south-west craters) without any noticeable decrease of volume. The eruption of ash, however, has diminished to insignificant proportions, and is doing no harm. A curious result is that "during one period of heavy ash fall and dry weather the sheep got the usual 'eruption disease', which is caused by fluorine, but when a rainy period set in they somewhat recovered. The disease is, so far, not very serious."

With regard to the magnitude of the eruption, Dr. Einarsson is of opinion that the present eruption is at least as great as that of 1845, and will probably prove ultimately to be greater.

I visited Copenhagen on a lecture tour during October, and gained a few further details from Prof. A. Noe-Nygaard, and saw his very fine film of the eruption. The new crater on the summit is 300–400 m. in diameter, and has reached a height of 100 m. The orifice which continues to emit lava at the south-western end of the ridge is a fissure with six or seven small craters, very clearly seen in the film. The line along which the new eruption has taken place is situated some distance to the west of the still visible rent from which the eruption of 1845 was emitted. The film shows the minute details of the over-rolling and incorporation of solid lava-blocks by the liquid lava, and of auto-intrusion.

The accompanying map is re-drawn from a map published in the newspaper *Morgunbladid* (April 15, 1947) by Kjartansson, Hannesson and Thorarinsson. It shows the extent of the new flows (solid black) with additions (hatched) up to May 20. The very fine photograph of the eruption was taken by V. Sigurgeirsson of Reykjavik on the morning of March 29, the first day of the eruption, looking south-south-west.

Addendum. In a recent letter (November 9), Dr. Einarsson states that lava is still flowing in undiminished quantity from the crater on the south-west. Explosive activity ceased at the end of June. The lava is becoming very rich in gases and is more fluid than before, while the temperature remains constant.

CORN (*ZEA MAYS* L.) GENETICS IN THE UNITED STATES

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MAIZE (*Zea Mays* L.), or 'corn' as it is known throughout North America and so called throughout this article, is by far the largest crop grown in the United States, having many different uses ranging from animal food, a basis for the manufacture of nylon, to its use as table sweet corn. It is therefore not surprising that much time and money are spent investigating the corn plant. In addition to its economic importance, corn possesses a number of properties making it useful experimental material for cytologists, geneticists, plant breeders, and for evolutionists interested in the origins of cultivated plants. Some aspects of the genetic and breeding problems now attracting attention and an indication of lines of approach for solving them will give a brief indication of current work with this plant in the United States.

The problem drawing very wide attention at the moment is how to estimate combining ability of inbreds used in the production of hybrid seed corn. Modern strains of corn used commercially throughout the United States are known as 'double crosses' derived from crossing four inbred pure lines thus : $(A \times B) \times (B \times C)$. It is therefore highly important to know what open-pollinated varieties still in existence are more likely on inbreeding to give rise to inbreds which have the ability to produce the largest amount of hybrid vigour when crossed with other inbred lines. Jones, Singleton, Nelson and Hayes believe that it is best first to obtain the inbreds themselves possessing good plant characters before determining their potency in various combinations with other inbred lines, their principal argument being that it is no use having excellent hybrids if the inbreds which go into them are difficult to keep going from year to year. This is very important for the seedsmen. On the other hand, Jenkins, G. F. Sprague and colleagues at Iowa State College advocate early testing, that is, to determine the potency of different lines before inbreeding. General combining ability defined as the average performance of a line in hybrid combinations, and specific combining ability with a standard tester line, may both be used as pre-testers before commencing the inbreeding programme. Early elimination of varieties which pre-testing indicates will not produce inbreds possessing good combining powers, and selecting only the upper range, saves much labour inbreeding potentially unproductive material. The disadvantages of this method are, however, that testing requires a large amount of land and that open pollinated lines of corn are so heterozygous that often inbreeding has a drastic effect. There is no stability of the numerous genes segregating until after several generations of inbreeding, so that the combining ability of the derived inbreds has still to be estimated later, and this will vary *intra se*.

There has been some attempt to predict the value of inbred lines, using a cytological method. It now seems probable that the dent corn of the Mid-West was originally derived from hybridization between southern prolific dents and northern flint corns. Inbreeding mid-western dents releases variability, which manifests itself in plant habit and ear characters. The problem is to determine what two inbreds give the greatest heterotic effects and to determine whether this is predictable on the basis of the characters of the derived inbreds. It has been known that the greatest jumps can be expected from inbreds derived from open-pollinated varieties which differed widely in plant type and source of origin, for example, the northern corn belt hybrids which are dent corn crossed with flint corn, and the sweet dent silage hybrids. Inbreds derived from mid-west dents range from flinty types to extreme dent kinds. Longley had previously studied the positions of corn chromosome knobs, and Brown is now applying this method to inbreds derived from mid-west dents; those inbreds having knob numbers of approximately two are most like the northern flints, while those with higher numbers are more like southern dent corn. One would therefore expect that hybrids between inbreds of high and low knob number would be better than those between high knob numbers or between low knob numbers. Therefore a combination of seed characters and knob number of inbred lines may assist in reducing their number for testing and may indicate what inbred combinations are likely to prove most profitable.

The present basis for the hybrid corn industry has depended upon inbreeding different strains of open pollinated varieties to obtain the inbred lines, and then to make two sets of F_1 hybrids and cross these together to obtain the double-cross commercial hybrid. To obtain satisfactory homozygosity the lines may require not less than four or five years of selfing, and even then the amount of inbreeding depends upon how far the eye can judge the purity of such lines. Thus any method that could (*a*) short-cut the inbreeding programme and (*b*) give a more dependable amount of homozygosity would be valuable. Such attempts have been made. For example, a number of workers have investigated the effect of using pollen, sufficiently damaged by X-ray treatment as to be incapable of effecting fertilization, yet still viable and capable of growing down the style. By so doing it was hoped to stimulate haploid development of the egg cell without fertilization. So far results have been negative, and now Lindstrom is making a new attack on the problem, first by the application of numerous chemical substances to the silks to induce parthenocarpy, and also by exploring the possibility of using a method already successfully applied to *Linum*, namely, the selection of polyembryonic seeds in the hope that some of the embryos will be haploid. The haploid set of chromosomes can then be doubled with colchicine, immediately giving rise to autodiploid plants. Such plants would have much value in future investigations. It would seem, however, that these short-cuts must at the moment be considered more in the light of academic interest than of economic value.

Another problem of corn breeders is that even though they may establish inbred lines which carry with them the required amount of homozygosity to allow their use in hybrid combinations producing hybrid plants uniform for such quantitative characters as maturity, height and ear length, major mutations constantly occur. Jones first thought that degenerative changes were associated with the change in combining ability of the inbred lines; but now it seems likely that invisible mutations controlling combining ability continually occur in them, and are not readily detected until the inbreds are hybridized, either to inbreds from different sources or back to the original inbred lines. Hence the major degenerative changes only acted as stimulants for testing and so disclosing the cryptic mutations, but were not themselves responsible for such changes.

There are quite a number of general selection experiments with various types of corn for characters under multifactorial, or polygenic, control. One group of experiments refers to the selection of certain chemical constituents of the corn kernel. For example, at Iowa State College work directed towards the production of inbreds and hybrids of waxy corn is comparable with methods used for the production of field corns. The waxy gene corn was successfully utilized during the war years as a substitute for tapioca. Similarly, the oil content of kernels has been increased by the selection of strains with large embryos, hence increasing the value of corn feed. Many straight selection experiments with corn are being practised at the northern edge of the corn belt to obtain hardy lines which are also adjusted to the altered day-length of this area. Thus Minnesota, Wisconsin and Maine Agricultural Experiment Stations have developed crosses between flint and dent corn to give flint/dent hybrids with good plant and ear characters yet sufficiently hardy for the northerly areas. At the same time the Central Experimental Farm is selecting good flint lines for Ontario. So the corn-growing area is gradually moving farther north.

Another problem attracting much attention is the study of principles underlying the ability of some lines of corn to germinate after remaining under cold soil conditions while other lines are severely damaged. These investigations are being carried out at the Minnesota, Iowa and Connecticut Agricultural Experiment Stations and elsewhere. Hayes and his colleagues have now investigated the genetical basis for such phenomena, having established that different lines have different resistance to cold treatments. Haskell has determined the hardiness of some of the Connecticut inbred sweet corn lines and found, contrary to expectation, that they are not always worse than the behaviour of the starchy control under the conditions of the experiment. In general, although the usual experience of breeders is that sweet corn seed over a wide range of conditions germinates more poorly than that of other types of corn, this may not be due directly to the *Su/su* relationship, but to closely linked genetical factors and also to easier damage of the wrinkled sweet kernels during drying and threshing in the seed factories, which later allows pathogenic soil organisms to penetrate more easily. Commercial seed companies now use cold-room tests for determining the value of their corn strains. This is important, as the effects of the continental climate of the United States, with extreme hot and cold rapid changes in the soil at germination time, require strains to be adapted to such conditions. In general, it has been found that conditions of 50° F. for 8–10 days are most expedient for test purposes, and probably also as a selection criterion for a breeding programme.

Since the production of the first Golden Cross sweet corn by Glen Smith, hybrid sweet corn production has greatly progressed, with the adaptation of special inbreds and their hybrids for particular areas of the States. In view of the fact that sweet corn is primarily a canners' crop, great stress has been laid on uniformly maturing hybrids, and sweet corn breeders have established a complete series of early, medium and late inbreds and *single cross* ($A \times B$) hybrids, so that growers can use mechanical pickers and sweet corn canneries can work over a spread of time. Compared with field corn, sweet corn breeding has been to some extent simplified because single crosses may be used, the prices of seed being higher than for field corn. With the maturity range established, attention is now largely focused on quality testing. This is an elusive item to estimate, and although the sugar content of kernels is of some value, still the only satisfactory method is by tasting, usually in the raw state, rather than by any laboratory tests, such as estimating translucency, or puncture testing for pericarp tenderness. By experience, sweet corn breeders generally agree upon what good-quality sweet corn should taste like. Attention is also paid to the behaviour of the different sweet corn hybrids under freezing methods, since more ears are sent to market on ice each year.

Many of the northerly experiment stations in the United States and also in Canada are selecting early, hardy sweet corn lines. Owing to the sudden killing frosts towards the end of the season, these strains must be so adapted that seed is sufficiently matured for safe picking and for artificially drying before being otherwise killed on the ear. There have been various determinations of the optimum drying conditions. In general a temperature of 100° F. for three days is often sufficient to bring down the moisture content of the seed in the hard dough stage to a level permitting safe storage. Besides pushing sweet corn production northwards there is also an active attempt to spread sweet corn for canning and direct eating into the Southern States, where white, dent corn is now grown for roasting. The resistance to the use of yellow sweet corn seems largely to be based on ignorance of the southern farmers and to the fact that no hybrid strains have been adapted to their climatic conditions, many northern hybrids being unable to meet the severe attacks of the corn ear worm in this region. These particular problems are now being overcome.

For a long time much attention has been paid to the history of the corn plant, concerning the origin of present forms and how it spread through the North American continent with the movements of the early American Indians. In addition, corn is one of the few cultivated plants the prototype of which has so far not been discovered growing wild in Nature, and its ear, so different from the female inflorescence of other members of the Gramineæ, offers interesting material for investigation. There is a division of opinions as to the source of corn. Mangelsdorf, Reeves and Merrill believe corn is a specialized product of selection by early American Indians of a grass that grew wild on the American continent. The present site of this prototype is still to be located, but evidence points to South America as the primary centre of origin. Teosinte (*Euchlœna*) is a hybrid between maize and *Tripsacum*, and is not a progenitor of maize, although where teosinte grows as a weed in Mexican corn fields there is a high incidence of hybridization. On the other hand, Edgar Anderson suggests that besides genetical indications, there are several pieces of ethnological evidence which suggest Burma as a possible source for the origin of corn. He has enumerated several pieces of circumstantial evidence showing similarities between Asiatic and Pre-Conquest civilizations. In addition, it is known that other members of the Tribe Maydeæ, to which maize belongs, occur in tropical Asia.

Similarly, views on the origin of sweet corn are at variance, Mangelsdorf believing that the *su* mutation for sugary kernels has occurred spontaneously in different areas throughout America, and has been adopted by local farmers in those areas for specialized use, such as making fermented liquors; while Edgar Anderson conceives that the sugary mutation has gradually spread northwards across the American continent from a more southerly point of origin. At the present time, although much light has been shed on these problems, the origin of corn still awaits a final solution.

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ASPECTS OF THE LOCOMOTION OF WHALES

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REPORTS of the 1946–47 British Scientific Expedition to the Antarctic Whaling Ground have revived interest in the locomotion of whales and other marine mammals and fish. Some interesting studies and information on this subject already exist, but many of the reports of speed recorded in the past have proved rather conflicting in character. Care appears to have been taken on the recent Expedition to obtain reliable observations, and it now appears to be substantially confirmed that a blue whale can attain a speed of 20 knots for a short burst of about ten minutes duration, and maintain a speed of 14½ knots for two hours and probably longer. A killer whale may obtain slightly higher speeds.

The shape of fish and marine mammals has naturally been an inspiration for the forms of underwater bodies for a great many years, and investigations have been carried out accordingly. It is pertinent to examine whether any lessons can be learnt from the whale and other marine creatures that can contribute to faster speeds of submarines and other underwater locomotive bodies.

Particulars of the shape of fish and marine mammals were given so long ago as 1919[1]. The form is not unlike that of a good streamline body. A blue whale of normal proportions may be about 90 ft. long and as much as 120 tons weight. The shape is illustrated in Fig. 1.

In order to propel a smooth rigid body of this size and shape at 20 knots, it is estimated that 520 horse-power would have to be developed by the whale. The estimate for other speeds is shown in the curve in Fig. 4. This curve is deduced from measurement of the resistance of models of smooth rigid bodies towed in water. These bodies form eddies which account for a fair proportion of the total power. It may be argued that the whale may succeed in avoiding eddy resistance by the natural flexure of the tail and