SCIENTIFIC BREEDING OF ANIMALS AND PLANTS

BY M. HAMILTON TALBOT

The problem of finding food for the new millions which are being added to our population—at the rate of 4,000 a day—with the area of the country not increasing at all, looks like a serious one. The solution, however, is found in the new science of breeding, which is adding other grains to the ears of wheat and corn, producing two blades of grass where one

do not equal this. Luther Burbank, the dean of the American school of plant breeders, recently said: "The right man under favorable conditions can make one dollar yield a million dollars in plant breeding."

The twentieth century scientist in looking for food for the new millions found Nature too slow, so he took the grains and the fruits and forced the most astounding marriages; and in place of natural selection, the law of wild life, he has established artificial selection, which is a thousand times faster and a thousand times better adapted to human needs. He has created new wheats able to withstand great cold, new corns rich in fats or in proteids, new potatoes with a larger sugar content than ever before; he has developed hardy oranges, plums, apples, and other fruits; long-staple cottons, high-

binations of *centum* and *genera*, which means a hundred (more or less) of one birth having a common parentage. Breeders search for this phenomenal strain, and when found—the one in many—all others are discarded, and this superior blood is multiplied,

Planting centgeners (100 hill plots) in crop nursery.

A seed is dropped into each cup and cups are emptied; then machine is drawn ahead four inches and seeds again planted.

grew before, and giving us superior breeds of animals. The work accomplished by scientific plant and animal breeding in the past decade has already increased the value of our farm products from ten to twenty per cent, and ten to twenty per cent of increase on four billion dollars worth of our farm crops and three billion dollars worth of our animals means approximately a billion dollars annually in additional profits to our farmers, and all at a trifling cost. The investment of every dollar in scientific breeding yields a hundred dollars, or ten thousand per cent. Gold mines

yielding cereal grains, and various other plants never before seen on our planet.

Heredity is the science which is originating these new plants and new animals, and it is rapidly coming into man's hand to be used to increase production. Scientific breeders believe that every species can be improved by breeding, that every species has in it a blood strain with rare value for producing along desired lines, rare centgener power. The word *centgener*, which has been coined for use in expressing the breeding power of the individual plant or animal, is a com-

Hybrid wheats produced by scientific breeding.

The two middle wheats are hybrids resulting from a cross fertilization of the two outside varieties.

and made to take the place of their half-civilized brothers. By this centgener method the breeder first secures many superior plants, and a hundred or more of each parent are planted; and by comparing the average of the progeny of the respective parent plants, the power of each parent to project its own individual values into its progeny is measured, and the seeds of those relatively few parent plants which beget the best strains are preserved and made into new pure-bred varieties. By this means the parent plants are

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The crop nursery at the Minnesota experiment station.

Showing how new varieties, such as flax, wheat, and clover, are originated, and old ones improved. Erect bundles of grain in foreground are each of new quality of wheat carefully harvested and tied up with cloth to prevent loss of grain.

SCIENTIFIC BREEDING OF ANIMALS AND PLANTS.

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upon the upper half of the shafts, rigidly welded together with two side sheets, forming the hoe spike and terminating in the head piece. This piece is fitted with two bolts, against which the hoeing tool itself is pressed by a spring fixed between the two side sheets. The above-mentioned holding piece is held on the shaft by a spiral spring, wound around, allowing for a flexibility in any direction, while the spring, fixing the tool itself, permits giving away forward or backward and swiveling sideways, to avoid any obstacles, such as stone, roots, etc., and later compels the tool to return to its original position.

The force actuating the hoes when the drum rotates is the centrifugal force combined with the gravity. The regulation of the phase and the energy of successive blows is done by a latch mechanism, permitting the hoes to swing out at the right moment and catching and holding them again, after having performed this work in the ground. The drum has a diameter of 3½ feet. In front of the main driving tool may be placed a dovetailed forecutter, suited to cut the top grass clod and to tear it down into the spaces opened by the main knives in order to have it buried under the clods. Upon one hoe shaft from 16 to 24 hoes can be placed side by side in the actual type of machine, allowing for working a strip 7 to 8 feet wide, sufficient for three rows of corn, cotton, or potato plants.

According to the work to be done, the hoes can be changed; light against heavy ones, pointed against flat ones, long ones against flat-working ones (peeling). The changing is done by hand, without unscrewing any bolts and without requiring any special tools.

With one man to operate it and with a gasoline consumption of two to three gallons per hour, the following work is performed by the machine:

	Depth, Inches.	Output, Acres per Hour.
As peeling machine.....	3 to 4	1 to 2
Hoeing machine.....	6 to 8	½ to 1
Hoeing machine.....	8 to 10	0.45 to 0.90
Hoeing machine.....	10 to 14	0.40 to 0.80
For very hard and heavy ground, where plows and motor traction are unfit to do any work.....	6 to 8	0.40 to 0.80

Studying these figures, it must be considered that the machine renders the soil ready for sowing, and it hauls any roller or sowing machine attached to it, when performing its work.

SCIENTIFIC BREEDING OF ANIMALS AND PLANTS.

(Continued from page 440.)

compared in a far more vital way than by simply comparing their yields.

This centenary method of breeding was originated by the Hon. W. M. Hays, Assistant Secretary of Agriculture, who stands at the head of a group of men who are conquering a new earth. More than twenty years ago he began experimenting with our field crops, trying to increase their yield, and his unique methods have been developed into a system with a most wonderful organization of detail in selecting seeds, planting large broods of single mother plants, recording the performance of individual plants, and in tabulating and displaying the pedigree values of the thousands of newly created pure-bred varieties, which is now recognized as the most important method followed by scientific breeders.

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all public institutions and also with private breeders in this work.

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is actively associated with The Outlook as a member of its editorial staff, and those who wish to know what he really has to say on matters that concern the Nation's welfare will find his views fully expressed in The Outlook over his own signature. His writings on current topics do not appear in any other newspaper or magazine. Under the title "American Workers in Town and Country" Mr. Roosevelt will contribute three or four articles early in 1911 dealing with the social and industrial problems of the miner and farmer. The articles are based on his visits to the Pennsylvania coal mines and to the abandoned farms of New York.

"The New Nationalism" is the title of an attractive volume containing the important addresses of Theodore Roosevelt's recent Western Tour, carefully revised by the author, with a descriptive introduction by Ernest Hamlin Abbott, who accompanied the party. It includes all the speeches that have aroused such insistent discussion throughout the land—the Osawatimie speech, the Denver address on the Supreme Court, the Columbus address on Oppression and Mob Violence, the Chicago speech on Public Honesty, and the speech on Conservation. This is a book of lasting value and National importance.

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amazing achievements. Longer years, however, are required in this field for accomplishing results. Special breeds of bacon hogs, with long sides of uniform thickness with alternating layers of fat and lean, have been created through the efforts of the Minister of Agriculture of Ontario, Canada, in his efforts to gain in England a market for Canadian pork.

The growers of cattle and users of meat have had a great wealth brought to their barns through the far-seeing patience of Cruikshank, the originator of the famous Shorthorn cattle, noted for their superior meat-producing qualities. In Colorado there is now being bred a type of horse peculiarly fitted for both carriage and heavy driving vehicles, through the efforts of Prof. Carlyle, with help from the Federal Department of Agriculture. The nucleus of this new breed is on the agricultural college farm, but the ranchmen of Colorado are aiding in the work of implanting on the State's vast horse-raising area these large, beautiful, and enduring drivers, for which there is an ever-growing demand, both in domestic and foreign markets, notwithstanding the popularity of the automobile.

The governments of the world now consider expenditures for building up the science and the practice of agriculture and the work of creating better types of plants and animals as necessary as expenditures for an army and navy. By both selective and creative breeding, in part under public patronage, increases will continue to be made in the value of our plant and animal productions equal to our military, naval, and educational expenditures. And without increasing our cultural acreage, there will be plenty of food for as many millions as we are likely to have—all through this new science of breeding.

TYPEWRITER OPERATING WITHOUT NOISE.

(Concluded from page 441.)

surface, flat-faced type are used instead of the ordinary concave type. This overcomes a difficulty common to machines using a rubber roll for the platen in which the diameter of the printing surface varies with the number of copies made, resulting in blurred impressions when the curvature differs materially from that of the type.

In order to produce a noiseless typewriter, it is necessary not merely to keep the key and typebar movement quiet, but to make the escapement, shift, and back spacer movements silent, as well. This result has been accomplished by the use of ratchet pawls and dogs fitted with cam surfaces so that there is no clicking noise whatever. The escapement mechanism is very ingenious. The pinion at the upper end of the escapement wheel shaft engages the carriage rack and must be capable of movement to allow for adjusting the carriage toward and from the printing position, as explained above. The escapement pawl, however, is mounted in the fixed part of the machine. In order to allow for such relative movement the shaft is mounted on a globular ball-bearing; that is, the cones of the bearing are spherical, so that there will be no binding, whether the upper part of the shaft is moved forward or to the rear and out of the normal vertical position. The silent cam-faced escapement pawl is clearly shown in one of the detail views. Everything has been done to hush the slightest click. Even the bell that gives warning when the end of a line has nearly been reached makes a very faint "ting"; but this sound is amply loud, considering the silence of the rest of the machine.

Copying Old MSS.—To make old writings plainly legible for copying, dissolve 150 parts of oxalate of ammonia, of potassium, or of sodium, 0.8 part of ferrocyanide of potassium, 0.06 part of vanadate of ammonia in 1,000 parts of water, and when copying use this solution to moisten the faded places.

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