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re necessary. Over the cellar in question, such beams could be laid either lengthwise or crosswise, as might be most convenient, and supported in the center. Above the beams, lay the concrete, mixed one to four, to a depth of at least five inches, and reinforced by expanded metal or wire webbing, being imbedded in it about an inch from the bottom. The webs of this special reinforcing material should, of course, be laid crosswise of the beams below, and there should be sufficient to be laid close together over the whole size of bridge. Spaces for manholes should be left or cut out, and extra reinforcing of half-inch iron rods placed around them. Your county engineer will be able to tell you where necessary reinforcing material and steel beams may be procured.

3. Some ventilation is necessary. The manhole might be used to some extent, and there could also be four-inch tiles laid crosswise in the side walls, near the top, which could be stuffed with straw when not needed. A covering of earth is necessary over the bridge to prevent slipping, and to keep out frost during hard weather.

Recent Science in Plant and Animal Breeding

Civilized countries are discovering that by breeding, the annual product of domesticated plants and animals may be increased several billions of dollars in value, thus lessening to some extent the inevitable increase in the cost of food and clothing to the consumer, while not decreasing the returns per acre of the producer. This economic concern and the interest men take in delving into science are uniting to impel men to develop the science of breeding and to utilize this new knowledge on a scale commensurate with the interests of the nearly two billions of people which the world must feed.

Modern facilities for the transportation of thought, of men, and of materials will soon have obliterated the partitions between the countries of the earth, throwing all of mankind into one community. Already science knows no national lines. Commerce is constantly increasing the fluidity of trade between nations as well as between states. Men not only bring the ideas of all countries to one new country, but they mingle the blood of many races of men into a common stream. Domesticated and wild plants and animals are being transferred from their original habitats to all other regions where they may respectively prove of value, either in their purity or when re-combined into new types. Under modern science the Mendelian unit characters are being sought out, transported and, by breeding, assembled into newly fashioned varieties, breeds, and even species with enlarged economic values for each given locality and purpose. And science is not only organizing the vocational education, even of all the productive classes, but it has begun to study heredity in man and to at least dream of the possibility of re-combining the virtues of the different families in grander races of people.

For the most part, variety and breed improvement is and probably ever must be a relatively slow and tedious process. In most lines there has been discovered no method of making rapid improvements. None better know the falsity of claims of marvellous and rapid changes by breeding than those who make these claims.

Exaggeration is the most dangerous enemy to plant and animal improvement and to the sane consideration of eugenics. On the other hand modest increases in plant and animal products when applied to hundreds of millions of farms give increased billions of products. The day is rapidly coming when public authorities and private interests will be justified, by achieved results in breeding, in making all needed investments of money and time in creative breeding along lines of economic improvement.

The breeding of living things cannot be wrought out under the rigid application of scientific facts and formulas as can the construction of a drainage system, a railroad or a manufacturing

plant. Under the guiding hand of science, art in breeding must also have scope. In fact, in no other line is there such large and complete union of science and art. Along with the broad scientific conceptions of Darwin, the mathematical precision of Mendel, and the statistical records of performance of the modern plant breeder, there must be the art of the sculptor, of the painter, and even of the musician, all put into operation with somewhat of the genius of a Burbank.

Breeding is becoming so much of a technical profession that a close division of labor is rapidly becoming important. It may be expedient for a few men to work with a large number of species and genera, that they may perform the special service of giving a broad scope to the general subject of breeding; but for the most part, more rapid and larger results will be achieved by each worker concentrating on a given species or on a group of related species. Many men have already fully demonstrated that scattering, discontinuous efforts, using small numbers of each of a number of unrelated species, is the way to get nowhere in creating improved forms of plants and animals. No doubt that even as great a genius as Burbank would have to his credit a far larger economic addition to America's plant products had he confined his efforts to half a dozen important species. Your humble servant worked for twenty years with about twenty species, the purpose being in part to gain a broad view of the subject of breeding, and to prove the large economic value of plant and animal improvement. The creation of new forms of the great staple crops was rather a secondary consideration. But even in this case better scientific as well as far larger immediate economics results would have accrued if the work had been confined to not more than one-third of the species used.

The creative breeder who works with one or a few species can compass the collection of all needed basic materials from all parts of the world. He can not only learn the unit characters of each acquired variety, but he can with a fair degree of success follow these unit characters in the re-combined forms which he produces by hybridizing. In other words, without a too extended variety of basal materials he can gain an intimate knowledge of the basal unit characters, as does the painter of the primary colors which he blends to represent on the canvass the desired forms and tones. It is true there are some species, as wheat and barley, yeast and bacteria, the breeding of which can be done in larger part under scientific performance, where it may be that mere art takes second place. On the other hand, in the breeding of strawberries, peaches, chrysanthemums and orchids the eye of the sculptor and painter and the taste and smell of the epicure are at least of equal importance with scientific records. The art-expression of a people is said to be the highest means of expressing civilization. Once the breeding of living things reaches that development of which it is capable, it may be that those most brilliant in creative breeding will have the highest place at the head of the class of artists. Certain it is that the molding of living things which express the greatest beauty of form, color and fragrance, will give to him who can apply science and art to living protoplasm, a scope for scientific knowledge, prophetic vision, and artistic skill far beyond that possible to apply through the chisel or through the brush alone. We need so to organize our work of creative breeding that the nations can command the talents of men with the greatest genius for all the phases of the betterment of plants and animals, by breeding.

During the past decade or so science and practice have begun a re-statement of the principles underlying heredity and breeding. The analysis of the subject, the nomenclature and the philosophy of Miles' Stock Breeding, which for the third of a century was the accepted textbook along this line, are now being rapidly re-organized. Mendel's laws of segregation, dominance, and recombination; DeVries' mutation theory and its corollary amply proven in practice; the need of using very large numbers in breeding; the possibility of organizing large and efficient breeding establishments; the introduction of the subject of practical breeding into agri-

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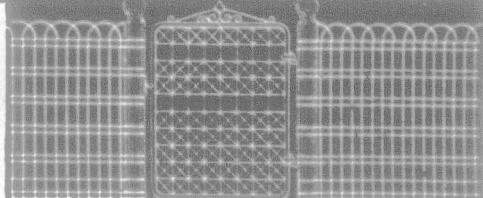
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