it is found to consist of two kinds-cellulur tissue and solid wood; in roots, scuh as the potatoe, the proportion of woody fibre is small in the earlier stages, but if allowed to remain in the soil till old, the woody part is much larger, being increased at the expense of the other matter of the root. Starch, next to woody fibre, is most abundant and most important, and is one form of the ingredients which constitute the food of animals. To obtain this starch, take the flour of any of the grains and wash it with cold water through a cloth or sieve ; a milky liquid passes through, and deposits the starch in the cold water. One of the tests of the presence of starch is a solution of iodine, which invariably produces a blue colour when it comes in contact with starch, and a very minute quantity of starch may be detected in this way. Starch consists of the same elements as woody fibre ; hence, the facility of the conversion of one body into the other. Starch exists largely in the seeds of plants, and in some roots. Gum is a proximate principle, next in importance to starch, in a great variety of vegetables ; it is obtained largely from the acacia tree, and is also prepared from a great number of common fruit trees; the composition of gum is the same as that of starch and woody fibre; it appears, therefore, that gum, starch, and woody fibre, are both represented by carbon and water. Gum is found in the roots of many trees, and it is a general product of the vegetable kingdom. Next to gum is sugar or saccharine matter ; in the sugar cane, the maple tree, &c., sugar exists in large quantity, and is extracted for use ; it may be obtained from many roots, such as the turnip, carrot, and beet; in the latter it exists in large proportion, and sugar is manufactured from beet in France and Germany ; its chemical composition is the same as the other three bodies, and the constituents are in the same proportions ; a variety of sugar exists, termed grape sugar, which resembles cane sugar in being less soluble in water, and less sweet ; it is different also in the proportion of its constituents, having two times more water than cane sugar. These four bodies, then, woody fibre, starch, gum, and sugar, consist of these three elements, carbon, hydrogen, and oxygen, and of these the great bulk of vegetable products consists. There are other bodies which appear along with them, into which nitrogen enters. The proportion of starch in plants is as follows:-

STARCH PER CENT.

| Wheat flour | | | | | 39 to 77 | |
|---------------|-------|------|---|---|----------|--|
| Rye, . | | • | | | 30 " 61 | |
| Barley, | | | | • | 67 " 70 | |
| Oatmeal, | | • | | | 70 " 80 | |
| Buck wheat, | | • | • | | 52 | |
| Peas and bear | ns, | | | | 42 " 43 | |
| Potatoes (wa | ter 1 | 75), | • | | 13 " 15 | |

There thus appears to be a very small proportion of starch in potatoes, but then we are to take into account the large quantity of water ; the other grains are nearly dry, while in the potatoe there are 75 per cent of water, consequently if we remove the water, the proportion of starch is relatively large. Of the principles which contain nitrogen, gluten is the first and most important. When the flour of wheat is made into a dough, and washed upon a sieve, a milky fluid passes through, from which starch subsides, but on the sieve remains a a soft, tough, and elastic substance, without taste and smell; this is gluten. The other grains yield it, but in less quantity than wheat; when dry it resembles glue but is dissolved by acids. Gluten is one of the most nourishing substances we have; its proportion in grain is as follows :-

| Wheat, | • | • | • | | ·• | 8 to 35 |
|--------|---|---|---|-----|----|---------|
| Rye, | • | • | • | • * | • | 2 " 15 |
| Barley | , | • | • | • | • | 3 " 6 |
| Oats, | • | | + | • | • | 2"5 |

These different proportions show us one reason why wheat is more nourishing than any other grain ; it is the tough spongy bread. There is another principle associated with gluten, termed vegetable albumen, to distinguish it from animal albumen, as the same principle exists in both ani-

white of an egg; it has the property of coagulating when heated, and becoming solid. If the water used in washing flour to obtain gluten be heated and allowed to boil, small particles subside, and these are albumen ; when it is moist and fresh, it has neither taste nor smell ; it is insoluble in water and spirit of wine, but is dissolved by vinegar and the alkalies. The per centage of albumen is, in

| Wheat, | • | | • | • | • | 🕴 to 11 |
|---------|---|---|-----|---|---|----------|
| Rye | ٠ | • | . • | • | • | 2 " 34 |
| Barley, | • | • | • | • | ٠ | 1-10 *** |
| Oats, | • | • | • | , | • | 1-0 " 5 |

In the fresh juices of plants such as that of the cabbage leaf, it exists much more largely; when these are heated the albumen congulates; glutch and albumen appear to be as closely related to each other as sugar and starch; they consist of the same elements, and are capable of similar conformations ; when exposed to the sir in a moistened condition, they soon undergo decomposition, producing ammonia and acetic acid or vinegar. Another important principle is diastase; if malted barley be crushed and mixed with a large quantity of alcohol, a white powder falls to the bottom, and this is diastase; if we take a simi-lar portion of unmalted barley, none of this diastase is produced, but if the seeds have germinated it is produced ; it is obvious from this that dinstase is produced by the germi-nating process; it is only found in the germ, and remains there during the growth of the plant, and when the first leaves are formed, which adsorb carbonic acid and water from the air, it disappoars. Another principle, kindred to this, is dextaine; if the solution from the barley be mixed Another principle, kindred to with starch and heated to half the heat of boiling water, the whole of the starch is dissolved, and if the water be carefully evaporated, a yellow powder is obtained, and to this the name of dextaine has been given. Diastase has the property of changing starch first into gum and then into grape sugar ; one part of diastase will convert 2,000 in a solution of malted barley, it would probably increase their germinating powers; a solution of diastase, also, soon undergoes decomposition, and it yields a large quantity of ammonia ; from this enumeration of its properties, we can understand the functions of this principle; the starchy food of the germ is prepared for the use of the plant, but in consequence of its being insoluble in water, it cannot be taken up by the store of the plant. taken up by the young plant; for this reason diastase is formed at the point where the germ first rises ; it is pro-duced from the starch itself, and as soon as it is formed it renders the rest of the starch soluble in water, and therefore fit for entering into the vessels of the plant; when the starchy matter is exhausted, the action of the diastase ceases; it is only necessary till the leaves and roots are fully formed. Along with this principle there are some vegetable acids, such as acetic acid and oxalic acid. Acetic acid is the most extensively diffused of the organic acids ; it is formed during germination, and exists in the saps of many plants, but it is most largely produced during the fermentation of vegetable products : combining with the alkalis it forms salts which are soluble in water ; in the fermentation of vegetable matter carbonic acid is evolved, and oxygen absorbed, and it is from changes of this nature that this acid is found in the bases of plants. Oxalic acid has been already described; as it does not exist in the soil, it must be formed by the changes carried on in the vessels of the plants. The other vegetable acids being chiefly found in fruit and fruit trees, and scarcely existing in vegetables cultivated for food, it is not necessary for our present purpose to notice them.

HYBRIDIZING.

Among the many contrivances by which man has succeeded in converting the wild productions of untamed nature into bodies better adapted to his artificial wants, nothelastic principle of gluten that gives flour the power of ing has produced more past advantage or promises more swelling up in sponge and fermenting; in oats it is small future profit than hybridizing. We shall not refer in this in proportion and from oat flour we cannot make the same place to what has been done in the animal kingdom, but confine the attention of the reader to its effects upon vegetation.

The practice is regarded as one of very recent date; and mais and vegetables ; the purest example of album en is the | so it is, as an artificial process, applied by rule to definite