

nearly untouched; but by alternation of crops, the latter may be made available for the purpose of growth. Farmers on this account have different crops succeeding each other in the same field. Wheat, barley and oats, are described as silica plants; peas, beans, and clover, as lime plants; turnips and potatoes as potash plants. These crops from the difference in their predominant inorganic ingredients are made to alternate with each other. The three rotations most commonly followed are the four-course shift, or what is known, as the Norfolk system, the five-course, and the six-course. The four-course shift usually consists of 1st year, turnips; 2, wheat and barley, and in many cases wholly barley; 3, grass; 4, oats. The five-course is formed by simply allowing the grass to remain for two years; while the six-course shift, or system of rotation, consists of—1, turnips; 2, wheat and barley; 3, clover; 4, oats; 5, beans or potatoes; 6, wheat. The system of rotation, in other words the number of years over which it extends, varies in different countries.

In some virgin soils, rich in phosphates and other inorganic matters, the same plants may be cultivated successfully for many years. This occurred in Virginia, where for 100 years, the same crops were grown without manure; but ultimately exhaustion took place, and the crops became deficient. On lava soils there are often good crops. Thus the soils of Versuvius, formed by disintegrated lava produce excellent crops for many years in succession. It must be remarked, however, that frequently important materials exist in the soil in an insoluble state, and that unless means are taken to render them soluble the plant cannot avail itself of them. A soil thus considered as comparatively barren, may in reality have abundant materials of fertility in its composition.

There are few cases, says Sir John Sinclair, where the same land will constantly yield one and the same plant, or where a repetition of the same crop, or indeed the same species of grain, without some interval, is not found to be injurious. Hemp is one exception to that general rule; for in Russia, the same ground invariably produces it, without either fallow or any mixture of crops, but in consequence of great quantities of putrescent manure being annually applied. It appears from Mr. Butterworth's experiments that carrots have been successfully cultivated for seven years, on the same ground. In some instances, Bear or Big has been sown for years on the same ground in succession, but in general, a change, or rotation of crops, has been found not only expedient but necessary. Indeed every farmer who conducts his own operations on rational principles, will be attentive to such a change.

In theory, there is certainly no absolute necessity for alternation of crops when dung and labor can be readily procured. (Vide Boussingaults "Economic Rurale," p. 452 et seq). But, says the Chemist-Farmer of Bechelbronne, "there are nevertheless certain plants which cannot be re-produced upon the same soil advantageously except at intervals more or less remote. The cause of this exigence on the part of certain vegetables is still obscure, and the hypothesis for clearing it up far from satisfactory."

Without following out the subject more fully in its chemical ramifications, we shall proceed to discuss its practical details. It has been pointed out by Sir John Sinclair that the propriety of adopting any particular rotation must depend on a variety of circumstances, more especially the following: 1, On the climate, whether it is wet or dry, wet climates for instance being favorable to the production of oats, dry climates for peas, and for the harvesting of beans; and the rotation to be adopted in each climate ought to be formed accordingly; 2, on the soil; for clay, loam, or sand, have each various crops best calculated for them; 3, a rotation must also depend upon the situation of a farm, in regard to the probable sale of its productions, for instance a field of Potatoes near a great town or on a line of railway or near a wharf, would realize a much larger sum than one of the same size would realize in a remote part of the country; 4, on the means of improvement by extra manure, as lime, marl, sea-ware, town dung, &c.—"The celebrated Duubar rotation of, 1, Turnips; 2, Wheat; 3, Clover; and, 4, Wheat, could not according to Sir John, have been possibly carried on without the command of sea-ware, which that neighbourhood possesses; and 5, the rotation must also depend on the state or condition of the soil, whether it be old cultivated land, or a new improvement; whether it be land which has been cropped judiciously or by exhausting management; whether it is in good heart, or the reverse, whether it is foul or clean.

The Historian of Scottish Husbandry has laid down certain maxims, which have been recommended as the best calculated to lay the foundations of judicious systems of rotation.

1. A farmer must have more than one kind of crop upon his farm; indeed he could not otherwise carry on his business. For instance if he had nothing but wheat, he might not be able to procure hay and oats, and so on. By having various articles, also, he does not run much risk, either in regard to the season, or to the sale of produce afterwards. Besides if a farmer were to cultivate but one crop, he might often be materially affected by one unfavorable season; or, if the article which he raised was not saleable, the land had better have remained unploughed.

2. To have the crops so arranged, that the labour of ploughing for each, or sowing, weeding, reaping, &c., shall proceed in a regular succession, and that the labor or business be not too much crowded on the farmer at any one season of the year, nor any quantity of extra stock rendered necessary; but that the crops produced on the farm, shall be cultivated by the same hands, and with the same cattle. To this general rule, hand-hoers in spring and summer, and reapers in autumn, must form an exception.

3. To avoid forcing crops, or frequent repetitions of the same articles or species; as a diminution both in quantity and quality, except in very rare instance, never fails to be the consequence. By frequent repetition of the same crops (as we have already observed on the authority of Boussingault and others) the soil loses stamina, which neither manure nor culture can replace, and it is also to be kept in view that great luxuriance in vegetation can be made to take place without much real productiveness as we see where grain is sown on the sites of dunghills.

4. To avoid two white crops in succession, but alternately to have white and green crops. On this head it is contended that it is impossible to lay down general rules without modifying them by such circumstances as are often only to be known by real practitioners; and though the system of alternate green and corn crops is beyond question, an excellent one in general, deviations from it may sometimes be admitted; for instance, when old rich leys are broken up, two crops of oats in succession may be permitted. This however has been objected to by some of the ablest farmers, who maintain, that on dry lands the second crop should be either turnips or potatoe as the situation answers, and on clays either beans or fallow, which in general will pay better than a second crop of oats.

5. To avoid crops likely to encourage weeds; and founded on this principle, Lord Kaimes objects to the culture of pease, which, if not an extraordinary crop, are apt to foster weeds. If the land has been previously fallowed for wheat, and thus cleared of weeds, pease, after wheat may be hazarded. This doctrine however is in a great measure superseded by modern improvements.

6. To raise those crops the most likely to be productive of manure; hence green crops are to be recommended, and barley is to be avoided, producing when compared to crops, the smallest quantity of straw.

7. To arrange the crops so as to keep the land in good condition and increasing, rather than diminishing in point of fertility. This is best accomplished by alternate husbandry (or white and green crops in succession), and giving every