

Plant Succession in Relation to the "Genya" # (Natural Grass-land) Management in Japan.

By

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Introduction.

From the agricultural point of view, the "Genya" (Natural grass-lands) plays an important part in Japan, for the principal herbage which grow in the "Genya" are mostly applied to the fodder of the domestic animal or to the manure of the field, the "Genya" is said to be, therefore, the only place for the supply of these herbage.

There is pretty large areas of "Genya" in Japan ## and at present most part of it is managed rather extensively. In order to utilize these vast "Genya" more intensively, therefore, it is necessary not only to make an adjustment but also we must find out some methods for improvement and endeavour to reap herbage as much as possible from the same acreage.

Now, if we want to solve the "Genya" problem, we must first of all study the original character of "Genya", because this is the basis to settle the question.

In the present papers, I will discuss briefly on the transition of "Genya" from the stand point of the plant succession, but as there are much rooms for further study on the "Genya", I intend to continue those investigations.

Transition of the "Genya"

In our country, the "Genya" may roughly be classified into two divisions; hilly grass-land and plane grass-land. The former means a forestlands with grasses growing in the shade or such a grass-lands as we find on the remains of forest fires in the mountainous regions, and the soil belongs to quarternary formation or more older. The latter is what we call the "Genya", it is generally a plane or somewhat undulating grass-land, and this may also be divided into three geological parts, 1. "Genya" on the alluvial, 2. "Genya" on the deluvial, and 3. "Genya" on the skirts of volcanoes, terrace, etc.

These "Genya" do not always remain unchanged, that is, one type of grass is replaced by another successively.

These phenomenon known as plant succession is explained in many ways, but the most influential and universal cause of it is the addition of humus. The soil of the "Genya" is being changed physically and chemically by the addition of the humus decomposed the grasses themselves. Consequently, quite different grass-types are formed on the soil in different stages.

The characteristic types may be shown graphically in the following figures.

"Genya" is treeless natural grass-lands with various weeds and graminea which may be utilized for grazing or collection of herbage.

According to the annual report of statistics in 1930, the area of "Genya" in Japan is about 5,443,202 hectare.

Fig. I.

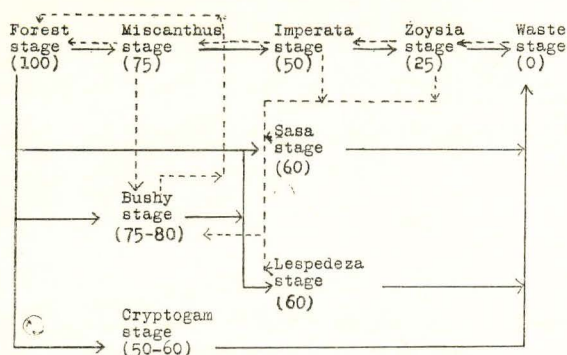


Fig. II. Grass and Soil Formation.

Grass phase	Soil phase
<i>Miscanthus</i> stage (climax type)	Rich in organic matter; available moisture content high.
<i>Imperata</i> stage (second grass type)	With moderate amount of organic matter, available moisture content to high.
<i>Zoysia</i> stage (first grass type)	Poor in organic matter, available moisture moderate to low.
Waste stage (transitional type)	Organic matter and available moisture content low.

(1) Forest stage:—

Most fertile soil, rich in organic matter.

(2) *Miscanthus* stage:— (climax type)

Miscanthus sinensis (Susuki, Zebra grass) is the dominant species in this stage. Besides, a few *Arundinella anomala* (Balen-shiba or Toda-shiba, Reedlike grass), *Themeda Forskali* (Megaru-kaya), *Andropogon Nardus* (Ogaru-kaya, Indian geranium) are mixed in this stage, and some shrubs as *Pinus densiflora* (Akamatsu) and so on grow here and there. These grasses are utilized mostly for the fodder and manure and for roofing, and they are also made for charcoal sacks. The soil is rich in organic matter and available moisture content is high.

(3) *Imperata* stage:— (second grass type)

Imperata arundinacea (Chigaya, Lalong grass) forms a pure association in this stage and mixed with the small shrubs as like *Pinus densiflora* (Akamatsu), *Rhododendron Kaempferi* (Yamatsutsuji, Azalea), *Borchemia racemosa* and *Salix Caprea* etc. The soil contains moderate amount of organic matter and moisture.

(4) *Zoysia* stage:— (first grass type)

There is a distinct predominance of *Zoysia pungens* (Shiba, Lawn grass) and *Scabiosa japonica*. Very little amount of organic matter and relatively little available moisture content are found in the soil, and it changes into the bushy stage.

(5) Waste stage:— (Transitional type)

This type stands on the so-called "Transitional stage", the grass consists of such inconspicuous, uneconomic forms as early maturing annual herbs with a algae and crustaceous lichens. Very poor in organic matter and little available moisture content are found in the soil.

Besides, there are various successional types on the "Genya", that is, from the forest directly to the *Sasa* or *Lespedeza* stage, or once passing the bushy and *Zoysia* stages and then to the Waste stage or similarly from the forest directly pass through the *Cryptogam* stage and to the Waste stage etc. these cases, however, are not worth while to consider, because it does not concern to the grass management.

The successional types from (1) to (5) abovementioned (showing by the thick lines in Fig. I.) are generally apparent when the natural conditions of the habitat have been disturbed either by physical or biotic forces, such as over-grazing, over-clipping or burning etc. and the rate of succession (the length of time for one successional stage continues) of every stage make a great difference according to the kind of vegetation, topographic feature, soil formation, climate and degree of disturbance by physical or biotic forces and so on. According to our experiments the rate of succession of every stage is considered as below:

From <i>Miscanthus</i> stage to <i>Zoysia</i> stage	10—30 years
„ <i>Imperata</i> stage to <i>Zoysia</i> stage	5—30 „
„ <i>Zoysia</i> stage to Waste stage	5—20 „
„ <i>Bushy</i> stage to <i>Sasa</i> or <i>Lespedeza</i> stage	5—20 „
„ <i>Sasa</i> stage to Waste stage	10—50 „
„ <i>Lespedeza</i> stage to Waste stage	10—50 „
„ <i>Cryptogam</i> stage to Waste stage	10—50 „

In a word, if it is managed rationally the successional period is kept long, otherwise it is short.

Here, suppose the soil fertility of the forest is 100, then the percentage of other stages would be, *Miscanthus* 75, *Bushy* 70—80, *Imperata* 50, *Lespedeza*, *Sasa* and *Cryptogam* 50—60, *Zoysia* 25 and Waste 0, respectively. (see Fig. I.)

Now, if the “Genya” were left alone, (showing by the broken lines in Fig. I.) all the *Miscanthus*, *Imperata*, *Zoysia*, Waste, *Sasa*, *Lespedeza* stages will be change into the *Bushy* stage and finally into the pure forest.

Among the abovementioned stages, the utilizable ones as grass-lands are only two stages of *Miscanthus* and *Imperata*, because they are worthy for some improvement or management, for instance, manuring, irrigation, fallowing, restriction of clipping or shading of grass-lands.

As for other stages, no improvement will be available. From our experimental data obtained from the various quadrat measurements, it seems that if the climax type once go back towards the inferior type, it will generally be hard to make forward march again towards the climax type, in other words, the negative succession is liable to occur while the positive succession is rather difficult.

In view of these facts, practically it is better to turn the “Genya” into the forest at once in the *Zoysia* stage, because the addition of organic matter will increase the fertility of the soil and moreover shading of trees will make grasses grow abundantly. This will be done easily by the artificial planting of trees on the “Genya”.

In short, the conversion of the forest and grass-land by turns naturally will be the most wise policy.

Conclusion.

The following conclusion may be drawn from the previous discussion.

(1) When the “Genya” (natural grass-lands) were managed too irrationally, i. e. over-grazing over-clipping or burning, both the grass and soil phases will change gradually to the bad condition, and the order of the successional stage would become *Miscanthus*, *Imperata*, *Zoysia*, and Waste; and successional of every stage will be long or short according to intensive or extensive treatments. The fertility of soil is high in the climax and low in the Waste stage. (see Fig. I. & II.)

(2) On the contrary, when the “Genya” were left alone, the proper shrubs (habitual species) grow out rapidly and it will finally be convert into the forest once passing through the bushy stage.

(3) Both the *Miscanthus* and *Imperata* stages should be managed rationally and also used long as possible, for these are only the utilizable stages as grass-lands.

Some improvement methods, such as manuring, irrigation, fallowing etc. may, therefore, be applied to these stages.

(4) Those stages below *Zoysia* are not worthy of utilization, and if they once changed into an inferior stages, they would be rather difficult to return to the former conditions. Under such circumstances, therefore, the soil can be made fertile by means of the afforestation and then we shall be able to use them as good grass-lands.