

THE IMPROVEMENT OF ALKALINE MEADOW BY ACCUMULATIVE SAND BY WIND IN THE SONGNEN PLAIN

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ABSTRACT: In the Songnen Plain, there are 330,000 ha of alkaline meadow, many sand sources such as fixed dunes, semi-fixed dunes and sand hills, and rich wind force resources as well. Sand has been stopped naturally and *Aneurolepidium chinense* has grown on alkaline patch of the plain. If we make use of the natural law and set up manmade obstacles in alkaline patches, we can use accumulative sand to cover alkali, improve alkaline meadow, restore *Aneurolepidium chinense* vegetation to develop animal husbandry.

KEY WORDS: alkaline meadow, accumulative sand, improvement of alkaline meadow

I. INTRODUCTION

The Songnen Plain is the major part of Northeast plain, and the largest one among the Songnen Plain, the Liaohe Plain and the Sanjiang Plain. It is bounded on the west by the Da Hinggan Mountains piedmont hill and platform, on the north and east by the Yilihuli Mountain and the Xiao Hinggan Mountains piedmont platforms, and on the south by Songliao Watershed. The outline of the whole plain is very similar to a rhombus.

The steppe in the Songnen Plain is little smaller than the whole rhomb plain, about 570 km from south to north and about 420 km from east to west. Its total area is 170,000 km². It is one of the best steppe in China, characterized by fine-quality of grass, and a few poisonous grass. It is also the key area for developing animal husbandry in China. However, there exist the comparatively serious problems of alkalization and degeneration in the meadow vegetation of Songnen steppe.

II. A SURVEY OF MEADOW VEGETATION

Li Chonghao et al once described Songnen steppe in 1981^[1]. The meadow vegetation in Songnen steppe reaches 4,000,000 ha, among which the salt meadow mainly consisting of *Aneurolepidium chinense* is 2,300,000 ha. The salt meadow makes up 57.5% of the total meadow area, and 34.2% of the total steppe area. The meadow vegetation is distributed on low plain, salt low plain, inter-dune depression, disk-like low-lying land and flood plain. The soil are meadow soil, gleyed meadow soil, carbonate meadow soil and salinized meadow soil. Due to high groundwater level, there is seasonally stagnant water on the ground. Salt meadow vegetation often forms different vegetation complexes, because it is affected by the change of water and salt caused by the undulation of microrelief.

The meadow vegetation can be divided into 3 subtypes, 15 communities. The subtype of salt meadow vegetation mainly consisting of *A. chinense* includes 8 communities. They are *A. chinense*; *A. chinense*+*Arundinella hirta*+*Calamagrostis epigejos*; *Aneurolepidium chinense*+*Phragmites communis*; *A. chinense*+*Chiors virgata*; *A. chinense*+*Puccinellia tenuiflora* *A. chinense*+*Iris ensata* and *Suaeda fauca*.

Comm. *A. chinense* is the representative vegetation, projective with the cover degree of 70%–80%, and herb layer of 50–60 cm high. In the community there are usually 10 species of plants, *Aneurolepidium chinense* is the dominant species, accompanying species includes *Potentilla flagellaris*, *Puccinellia tenuiflora*, *Artemisia anethifolia*, *Polygonum sibiricum*, *Phragmites communis*, etc. The meadow usually produces 1,000–2,250 kg of dry herb per ha.

A. chinense is famous for its fine quality, high nutritive value and good palatability, so it becomes the finest natural cutting grassland for the development of animal husbandry. But in the Songnen steppe, *A. chinense* meadow has shown the trends that the herb layer become thinner and shorter, the area of *A. chinense* shrinks, especially alkalized patch expands and alkaline area increases.

III. THE REASON OF MEADOW ALKALINE

Meadow alkalization is one form of steppe degeneration. In the Songnen Plain, strictly speaking, sandification and degeneration exist in steppe vegetation, while alkalization and degeneration exist in meadow vegetation. As stated in the previous paragraphs, salt meadow in the plain mainly consisting of *A. chinense* grows in the soils which contain salt in varying degrees, and some grows in alkali-saline soil. Therefore, it can be said that alkali-saline composition in alkalized meadow vegetation comes from the original soil on which meadow grows. As a result of the longtime environmental change, the development of soil and the succession of vegetation, salt meadow vegetation mainly consisting of *A. chinense* grows and develops in those soils. The biological effect of green plant makes salt to go down, that is to say, salt and plant keep such kind of dynamic balance, then pH value of the

soil is below 8 and *A. chinense* grows very well. With the development of social production, especially the rapid development of animal husbandry, the utilization degree has been greatly beyond the carrying capacity of *A. chinense* meadow, animals excessive gnawing and trample will reduce the yield of *A. chinense*. If such kind of overgrazing goes on, meadow soil will become hard, have bad permeability, and be not suitable for the growth of the main propagative organ (stock) of *A. chinense*. Thereby *A. chinense* gradually becomes thinner and shorter, finally dies off. Once odd alkaline patches appear in *A. chinense* meadow, if the above-mentioned utilization process goes on, the odd alkaline patches will gradually expand and become large alkaline part, finally form the present large pieces of alkaline plain, with surface pH value of 9, actually become barren land. In one word, meadow alkalinization in the Songnen steppe is mainly caused by destruction of salt meadow vegetation. It is estimated that now alkalinized meadow in the Songnen steppe reaches at least 230,000–330,000 ha. It has drawn the attention of various circles. Here we only discuss how to improve alkalinized meadow.

IV. EFFECTIVE WAYS TO IMPROVE ALKALIZED MEADOW

There are many ways to improve alkalinized meadow at home and abroad. Here, we propose a way to improve alkalinized meadow by using sand to cover alkali, which is an effective way to restore salt *A. chinense* meadow vegetation of the Songnen steppe.

In the Songnen steppe, local peasants have much experience in taking sand to improve small alkaline patches in farmland. However, no plant grows in large pieces of seriously alkaline patches, where pH value is 10 on soil surface and 9 below 15 cm. There are some small pieces of land which are a little higher than the other parts. Sand of 23 cm thick accumulates on the surface, pH value of soil surface is 8, therefore, *A. chinense* grows well, with a height of 50 cm, in those small pieces of land. If these small pieces of green land, on which *A. chinense* grows with the help of accumulation sand, are protected, they will continue to stop wind-drift sand to enlarge the grass area. When we pile up such things as sticks in alkaline patches near the steppe's villages, we find that sand is stopped and grass grows. In the vacant lots between trees along Changchun City's streets, *A. chinense* grows very well, which is the work of nature. All those practices show that the obstacles set up in alkaline patches can accumulate sand, reduce soil's pH, create the suitable condition for *A. chinense* growth, therefore, our aim to improve alkalinized patch is achieved. In the Songnen Plain, there are natural sand dunes and sand hills, and large pieces of alkalinized meadow as well, while the phenomenon of wind erosion and sandification exist. If we set up obstacles in alkaline patches, we can stop wind-drift sand, and control disadvantage with disadvantage, thereby turn disadvantage into advantage.

The aim to improve alkalinized meadow with sand on a large scale can only be achieved by making use of the law of natural wind-drift sand movement. There are rich sources of

sand in the Songnen Plain, and rich wind energy as well, especially in spring, the average wind speed in March–May reaches 5.3–6.5 m / s. When spring comes, wind–drift sand spreads everywhere. The focus of controlling alkali is how to stop wind–drift sand in alkaline patches or how to stop much more wind–drift sand while the expenses are reduced.

We put forward two ways to stop sand, one is to use tractors to turn up the soil into stripes or squares which form vertical or some angles to the main wind direction in alkaline patches. The width of stripe is 1–2 ploughshare, the distance between stripes is 4 m. And the square is 2×2 m, however, the square can be square, rhomb, oblique square or stripes (see Fig. 1). The other is to bury grass or shrub as obstacles to stop sand. The shape and size of the obstacles are almost as same as the above–mentioned squares.

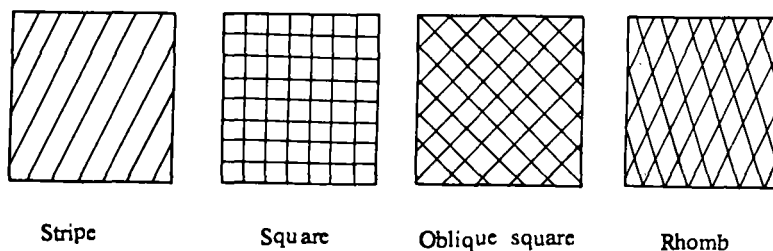


Fig.1 Obstacles size

V. CONCLUSION

In any place with sand sources, alkalized meadow, wind force and sand sources in windward side of the alkalized meadow, just like the Songnen Plain of China, we can make use of natural law to attain the aim of improving alkalized meadow by setting up wind obstacles in alkalized meadow, which has a low cost and obvious efficiency. So it is particularly suitable for improving large areas of alkalized meadow in developing countries and areas.

REFERENCES

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