Studies on the Methods of Utilization of Natural Grassland in Ecological Construction within Northern Agro-grazing Ecotone of Yinshan Mountains, Inner Mongolia

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Abstract: According to the peculiar ecological condition and its fragility in the northern agree-grazing ecotone of Yinshan Mountains，the way complemented with whole year of house-raising and seasonal non-grazing，in which natural grassland should be used in accordance with the time and place during the large-scale ecological construction in the future, the time and corresponding technological measures of application of house-raise and non-grazing fitting for the region most were studied as well，which provided theoretical basis for the reasonable utilization of the natural grassland in northern agri-grazing ecotone or Yinshan Mountains and the rejuvenation of degenerative grassland in this area by analyzing the reviving and growing regularity of native plants and the effects of pasture on the vegetation in the region，being aimed at the current situation of degradation and desertification due to the inappropriate use of grassland.

Keywords: agro-grazing ecotone, ecological construction, utilization of natural grassland, whole year of house-raising, seasonal non-grazing

1 Introduction

Northern agro-grazing Ecotone located at the middle part of Inner Mongolia，which between Yinshan mountain and Inner Mongolia Plateau. It's in the middle part of Northern agro-grozing ecotone which is one of the most fragility ecotone of China. It's also the most poverty area among agro-grazing ecotone and one of the most serious area that threaten by sand storm. Now, it's the main origin area of the sand storm that occur in Beijing and Tianjing. With a total area of 41,770 km^2, it covers 3.5% of the total area of Inner Mongolia. The area under cultivation is 15,010,000 hm^2 (according to the land survey of 1993), Covering 20% of the cultivated land of Inner Mongolia.

Northern agro-grnzing ecotone belongs to low hill and stratified high plateau land form，There are also many basin distribute in it. The main type of natural grassland in this area is low hill steppe and plain steppe. The main construction species are *Stipa Krylcvii*, Leymus chininess, Cleistogenes squarrosa, *Artemisia frigida*, *Agropyron michnoi*, *Thymus serpyllum*, and *caragana microphylla* etc.

Comparing to other grassland type, the productive is lower. The dry forage yield is about 705.15kg/hm^2—1,055.1kg/hm^2. Grassland usually distributes in small area and inland with the cultivated land. General to say, it has the condition for animal husbandry, because of long period unreasonable utilization, all the natural grassland has certain degree of deterioration and desertification. The deteriorated areas get to 69.8% of the total grassland. Water and soil erosion area cover 80% of the total-area. About more than 70% of cultivated land was desertification. The ecological environment keeps on worse. The main income of this area is agriculture and animal husbandry. It's one of the main grain product area in Inner Mongolia. Animal husbandry is also the supporting and traditional industrial. The proportion of land for cultivated, animal husbandry and forest are 36%, 50.6% and 4.83% respectively[2], because it located at the northern part of mid-temperate region and semi-arid area, temperature almost near cold zone, the main varieties that planted are cold-resistance and drought enduring crop. Main animal species is sheep. There are rich in straw resource in this area. Although straw is rich in this area,

only 38% were used as forage. If technological and material input were increase, there will be a potentialities for forage.

2 Situation of native grassland utilization

Although native grassland area gets to 21,110,000 hm^2 in northern agro-grazing ecotone, it distribute in small piece and can't be divided into seasonal rotation grazing pasture like others. For many years, the natural grassland has be used all the year round and only limited supplementary feeding from the beginning of winter to May of next year. Most of the forage still depends on nature grassland. This kind of extensive grassland use will destroy the grassland, especially grazing during early spring when grass begins to germinate. It's the main reason leads to grassland deterioration and desertification. In addition, over-grazing is also a problem in this area. In some area, over grazing rate get to 200%, which made the contradictory of forage providing and animal need. Grassland deterioration is seriously; large area of bare land can be seen even in growing season at some area. Edible fresh forage yields only 315kg/hm^2.

3 The effect of grazing to grassland vegetation

3.1 Analysis of seasonal changing of grass growth

Native grass growth pattern is a one-peak curvilinear under the natural condition of northern Yingshan Mountain area. Plants begin to germinate and grow when water is sufficient and temperature is stable above 5℃. On an average precipitation year, plant usually germinate during 20th, April to 4th, May. The growth rate increase as water and temperature increasing. From the end of spring to the beginning of summer, although temperature is increasing, but precipitation is not stable, so the biomass is the least, only about 10%—15% of the total. June is the key period for grass growing, but it's easy to have drought before the middle of June in this area, so the biomass is only 26%—46.3% of the total. After July, as the precipitation increasing, plant begin to grow as normal, the biomass can get to 70.4% of the total, and get to the peak in the middle of August, After September, the above ground begin to turn yellow and go to withered period.

The analysis of plant seasonal growth regular indicated that the key period for plant growth is during 20th, April to 20th, June. This period is "the sensitive injure period" for grassland vegetation, so it should be the non-grazing period.

3.2 Effect of grazing to grassland vegetation

Effect of grazing to grassland vegetation can be in many ways and changes as grazing pressure, technology and time changing. The nutrition needs of the animal is stable all the year round, but the growth of grass has a significant seasonal change. There must be some scientific and reasonable measures and methods used to deal the problem between the needs of animal and the supply of grass.

The growth of grass has some regular and limited. In early spring, plant used its storage nutrition to germinate. Grazing during this period will lead to the decreasing of plant storage, leaf area and root growth. Plant nutrition supply will decrease or even lose, plant will die when use up the storage. The late autumn is the period that plant seeding and transports nutrition to root. It takes time for accumulation nutrition. From the above, we can say there are two "dangerous period" during plant growth. If grass were gnawed and stripped in this period, it must lead to or accelerate grassland deterioration. General to say, grassland vegetation propagate mainly depend on vegetation reproduce, then seed. Although it takes long time for grass flowering and seeding, the amount of seed is large and there is seed bank. If only give a seeding chance every three year, it will be enough for the need of plant seeding reproduce. When useing the native grassland, we must avoid to use it during the "non-grazing period", especially the spring non-grazing period.

4 Measures for grassland reasonable using and rejuvenation

4.1 Carry out grassland seasonal non-grazing combine with whole year non-grazing

Because the forage supply and animal need is in a state of imbalance from season to season, especially over-grazing during spring, which is the main reason lead to grassland deterioration and desertification. In order to protect plant germination and early growth, improve the growth potentiality of plant, and rehabilitate grassland vegetation, the traditional whole year grazing must be changed and adopt some sencientific, reasonable, and easy handle grassland usage methods, such as seasonal non-grazing or period non-grazing combine with whole year non-grazing.

4.2 Measures for carry out the non-grazing

4.2.1 Combining with “quit cultivate and back to forest and grass”, enforce seeding construction

Northern Yinshan maintains agro-grazing ecotone is rich in land resource. Slope land which is not suitable for cultivation estimated 60% so of the cultivation land. For those land, water and soil erosion is seriously and must quit cultivate and rehabilitate vegetation. Nowadays, there is a large-scale ecological constriction is carrying out in this area. Combining with quit cultivate and back to forest and grass, planting perennial grass for hay is a reasonable way.

4.2.2 Make best use of straw resource

Northern YinShan mountain agro-grazing ecotone is a main area of grain production in Inner Mongolia. There is about 1,876,000,000 kg straw every year. The main straw are, wheat, rye, potato, corn, oil crap and legume straw. Straw is a rich “no-competitive” resource. Straw can be used in different purpose, such as, fuel, rotted-manure, forage and construction material etc, but the best utilization should be forage. Nowadays, the usage of straw mainly is for fuel. It coves about 50.42% fuel of the total, only little was used as forage and the utciz2ation rate is only 30%.

Straw contain about 40%—50% of the products of photosynthesis, The content of carbohydrate is almost the same as forage crap, but the content of lignin is higher, so the digestion rate is only 40%(forage crop usually about 75%). The lowest need of protein for ruminate livestock is 8%, but, straw only content 50%, so it need proceeding to increase the utilization rate.

4.2.3 Optimization of livestock structure

Confined livestock must dispose the animal reasonable and get rid of the old, weak and ill animal on time. For the breeding animal feeding, adults and younger must be divided, otherwise will effect the non-grazing indoor feed efficacy. Using of heterosis let foundation material mate with meat using made, decreasing feeding period, increasing lamb-feeding rate and live stock commercial rate. Using other one-third foundation material mate with the same production male, selection of good phenotype and use them as accredited herd to complement the elimination aged animal. So the no use feeding can be decreased and the economic benefit can be increased.

4.2.4 Building silage silos and stable with active area

According to the characteristics of ruminate animal, the housing animal need active area and shed, especially for those whole year house-feeding animal.

Silage is very important for house feeding and non-grazing animal. It can produce a cushion effect for the contradictory of grass growing and grazing in spring. The raw material for silage is mailing silage corn and seeding corn in this area. The key technology for silage is cut into small piece, water content, and press tightly. The type of silo usually can be under ground.

5 Conclusion

Due to the limited of harsh ecological condition and grassland deterioration and desertifiction, the only way for natural grassland utilization is house feeding and seasonal non-grazing in northern Yinshan

mountain agro-grazing ecotone. The key of seasonal non-grazing is preparing enough forage. Through planting large area of pennial forage crop and silage corn, etc, combining with proceeded of straw, enforces the relieaze of seasonal non-grazing. It's not only protection and resforetatin the grassland vegetation, but also not pounding animal husbandry. The income of farmers will not decrease and the ecological construction will speed up. According to the statistics in the end 1999, there are about 57,179,000 sheep units during spring-winter in northern Yin shan agro-grazing ecotone. The total need of forage for winter and spring non-grazing is 2,763,000,000 kg. Nowadays, the production of crop straw is 1,876,000,000 kg, after proceeded, the utilization rate is 88%, and so the edible crop straw can get to 1,646,000,000 kg every year. There are also produce silage corn and other forage crop 3,336,000,000 kg about 1,172,000,000 kg hay. Total production of straw and silage is 2,756,000,000 kg. There are still 50,000,000 kg hay needs to meet the animal demand. There are about 9,600,000 hm^2 land has been quit cultivation and back to forest and grassland. The vegetation construction is finished already, it can produce hay 100kg/hm^2 the total should be 48000000kg at least. That will be enough to meet the short of forage demand. In a word, carrying out seasonal non-grazing is a practice way in this area.

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