

Effects of Seeding Rates and Seedbed Preparations on the Seedling Establishment and Yield of Surface-Sown Pasture Species

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播種量과 播種床 處理方法이 걸뿌림한 牧草의 定着과 收量에 미치는 影響

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摘 要

본 시험은 播種量과 播種床 處理方法이 걸뿌림한 牧草 幼植物의 定着과 牧草의 收量에 미치는 영향을 究明하기 위하여 경기도 화성군의 구릉산지에서 2 년간에 걸쳐 수행되었다.

얻어진 결과에 따르면 orchardgrass의 定着은 ha 당 30-40kg 播種時보다 20kg 과종시에 유의적으로 높았으나, ladino clover의 정착은 과종량간에 차이가 없었다. 과종상 처리방법으로서 레이키질과 火入은 無處理區에 비하여 목초의 정착률을 유의적으로 향상시켰다.

Orchardgrass의 定着率에 대하여는 레이키질 한것이 화입한 것보다 有意적으로 높았으나 ladino clover에 대해서는 차이가 없었다. 목초의 과종량 증가는 걸뿌림 초지의 牧草收量을 높여 주지 못하였으나, 播種床 處理方法으로서 레이키질과 무처리는 목초수량을 유의적으로 증가시켜 주었다.

본 시험결과에 따르면, 목초의 정착률에 있어서는 레이키질과 화입처리가 효과적이었고 수량에 있어서는 레이키질과 무처리가 효과적이라고 할 수 있었으나, 목초의 수량에 대해서는 ha 당 20kg 이상 증량 과종량과 화입방법은 증수효과가 없었다.

(주요어: 播種量, 播種床處理方法, 幼植物定着, 걸뿌림牧草)

I. INTRODUCTION

It is estimated that about 66% of the national territory belong to mountainous areas in Korea. These large areas of land, however, are too steep and uneven for the use of conventional pasture establishment methods. Under these difficult circumstances, surface sowing methods involving minimal seedbed preparation offer possibilities for pasture improvement. The most widely used minimum seedbed preparation methods are mechanical preparation, use of herbicides, hoof cultivation and burning.

In Korea, MAFF(1987) reported that 74% of grass-

land was improved by surface sowing using herbicides, burning, hoof cultivation and raking during 1985-1986. At the same time the Korean government strongly recommended to use an excessively high seeding rate of pasture mixtures simply because deficiencies in establishment can be countered by increasing the seeding rate. Of the minimum seedbed preparation methods, herbicide treatment and hoof cultivation are well known as a promising method for surface showing (Campbell, 1968; Campbell *et al.*, 1981), however, despite of much discussion and experiments in recent years, burning or nor burning is still a matter of some controversy (Thomas, 1960) and also little is known

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concerning raking as well as seeding rate of pasture mixtures. This experiment was therefore designed to determine the effects of different seeding rates and seedbed preparation methods on the seedling establishment and yield of surface-sown pasture species.

II. METHODS

Experiment was laid down at Hwanam Farm, 16 km west of Suweon, on a steep hill facing north-west. Major shrubs and grasses in the experimental area were *Quercus aliena* and *Arundinella hirta*. The soil was light sandy loam and a soil analysis made in 1983 gave a pH of 5.0, medium exchangeable K_2O and very low available P_2O_5 .

The experiment was conducted using a split-plot design with seeding rates of 20, 30 and 40 kg/ha of orchardgrass (80%) and ladino clover (20%) as main plots and seedbed preparations, such as non-treatment, burning and raking as subplots. Each plot (1.2 x 3.0m) was replicated three times. After experimental plots were allocated, shrubs and native grasses were cut out from the non-treatment plots. Burning and raking were made as a seedbed preparation prior to sowing. Lime and fertilizer were applied onto all the plots as follows: 1,000 kg $Ca(OH)_2$, 50kg N, 150kg P_2O_5 and 100kg K_2O /ha in 1983, and 150kg N and 100kg N_2O /ha in 1984. Sumas orchardgrass and Regal ladino clover were hand sown at the rates of 20, 30 and 40 kg/ha on 23 August, 1983. Percentage establishment for pasture species was calculated from the seedling counts and the estimated number of viable seeds sown on 28 September, 1984. A quadrat 30cm long by 20cm wide was used for these counts.

Yields were measured by harvesting forage from an area 1.0 x 2.0m in the center of each plot on 23 May, 14 July and 18 October, 1984. All forage samples were oven-dried (105 °C) and calculations were made on this basis. Data were subjected to an analysis of variance, and least significant differences are presented at the 5% levels.

III. RESULTS AND DISCUSSION

1. ESTABLISHMENT

Fig. 1 and 2 give percentage establishment of pasture species at the seeding rates of 20, 30 and 40kg per ha using different seedbed preparation methods such as non-treatment, burning and raking.

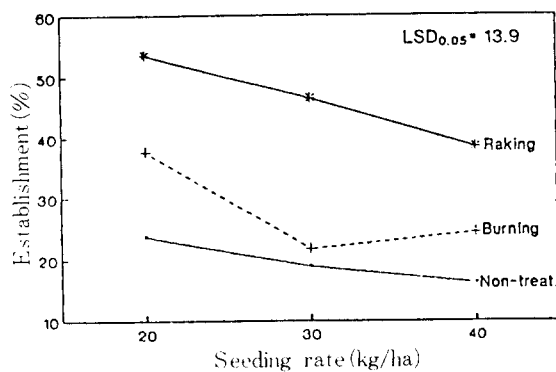


Fig. 1. Effect of seeding rate and seedbed preparation on the establishment of orchardgrass.

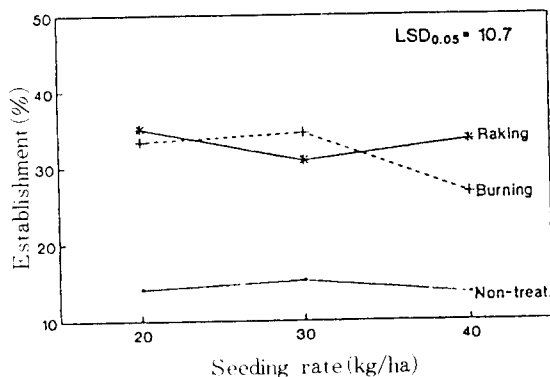


Fig. 2. Effect of seeding rate and seedbed preparation on the establishment of ladino clover.

From the results(Fig. 1 and 2) it is clear that increasing seeding rates of orchardgrass from 20 to 40kg gave decreased seedling establishment, but this phenomenon is less pronounced in ladino clover establishment. In other words, as seeding rate increased so did percentage establishment downward more in orchardgrass than ladino clover. Presumably this trend in the establishment between orchardgrass and ladino clover rose directly from species differences in early development and consequent inter-plant competition. The seedling es-

tablishment differences due to seeding rate, are more apparent when seeding rate means are compared, as in Table 1. The establishment of orchardgrass obtained from the seeding rate of 20kg was significantly higher ($P < 0.05$) than that from the seeding rates of 30 and 40 kg/ha, but no differences were found between different seeding rates of ladino clover. The results therefore confirm the earlier findings of Davies(1928), Heddle and Herriott(1954) and Chamblee and Lovvorn (1954), who reported that higher seeding rate of grass species reduced seedling establishment.

Table 1. Seeding rate and seedbed preparation means for establishment from Fig. 1 and 2.

Treatment	Percentage establishment (%)	
	Orchardgrass	Ladino clover
Seedbed preparation (SP)		
Non-treatment	19.6 ^a	14.3 ^a
Burning	28.0 ^b	31.5 ^b
Raking	46.2 ^c	33.5 ^b
Seeding rate (SR)		
20	38.3	27.5
30	29.0	26.9
40	26.4	24.9
LSD = 0.05	7.7	NS
Interaction (SP) × (SR)	NS	NS

Means not followed by the same letter differ at the 0.05 level probability.

NS, Non-significant.

As shown in Fig. 1 and 2, seedbed preparation methods significantly affected ($P < 0.05$) seedling establishment of pasture species. A significant higher establishment of orchardgrass was obtained by raking than by both burning and non-treatment, but both the raking and burning showed significantly higher establishment ($P < 0.05$) in ladino clover. The raking or burning prior to surface sowing was therefore one of the most suitable minimum seedbed preparation methods. McIvor and Gardener(1981) reported that dead plant cover can reduce seedling establishment by providing a physical barrier to seed-soil contact and or radicle-entry.

The fact that seedlings established less on the non-treatment plots may be partially attributed to lack of

optimum seedbed conditions due to dead leaves cover in this experiment. In an investigation of pasture establishment. Anderson and Elliott (1957) found that adapted species of grasses and legumes could be satisfactorily established on burned-over areas. Grant *et al.* (1958) described that surface cultivation, such as harrowing and rotavation greatly increased the chances of successful establishment. Carter and Sannders (1969) emphasized an essential feature of minimum seedbed technique in surface sowing. Present results agree closely with the conclusions of the above workers.

On the other hand, the trends in seedling establishment between seedbed preparation means were similar to the results of Fig. 1 and 2. However, establishment differences due to seedbed preparation, are more evident when the seedbed preparation means are compared, as in Table 1. A seedbed preparation × seeding rate interaction did not occur in this experiment.

In this experiment there was no evidence of an interaction between seeding rate and seedbed preparation. This is, the increase in seedling establishment due to seedbed preparation was not modified by the seedling rate of pasture species under nonarable conditions.

2. YIELD

The dry matter yields of pasture species at different seeding rates are shown in Fig. 3. As the medium seeding rate of 30kg per ha, the dry matter yield of 5951, 8729 and 8913kg per ha was obtained from burning, raking and non-treatment plots, respectively, but at the lower seeding rate of 20kg, the dry matter

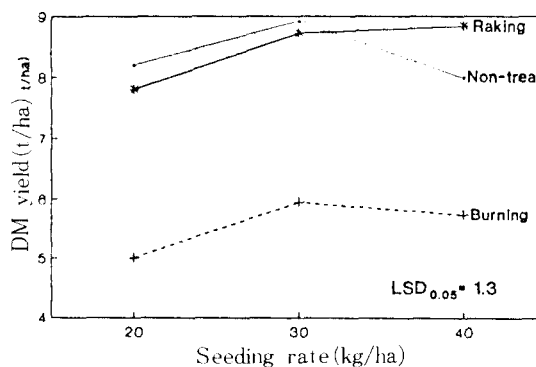


Fig. 3. Effect of seeding rate and seedbed preparation on the yield of pasture species.

yield of 4999, 7799 and 8196kg was obtained from those plots, respectively.

In this experiment as the seeding rate of pasture species increased from 20 to 30kg per ha, the total yield of dry matter was slightly increased, but no increase was observed when the seeding rate increased from 30 to 40kg. However, there were no significant differences in the total dry matter yield of pasture species between different seeding rate means (Table 1). For the dry matter yield of pasture species, the results obtained from this experiment agree with the general conclusions of some workers (Heddl and Herriott, 1954; Brougham, 1954; Kim *et al.*, 1973) that seeding rate had little effect on total dry matter yield.

Therefore if, under surface sowing conditions, lower seeding rate gave equal yield to higher seeding rate, it may be preferable to use the lower seeding rate. As shown in Table 2, there were significant differences in

Table 2. Seeding rate and seedbed preparation means for yield from Fig. 3.

Treatment	Dry matter yield (kg/ha)			
	1st cut	2nd cut	3rd cut	Total
Seedbed preparation (SP)				
Non-treatment	4038 ^b	2399 ^b	1933 ^a	8368 ^b
Burning	1978 ^a	1749 ^a	1837 ^a	5564 ^a
Raking	3962 ^b	2278 ^b	2216 ^a	8456 ^b
Seeding rate (SR)				
20	2837	2100	2063	7000
30	3918	2050	1897	7865
40	3323	2274	2026	7523
LSD = 0, 05	NS	NS	NS	NS
Interaction (SP) × (SR)	NS	NS	NS	NS

Means not followed by the same letter differ at the 0, 05 level probability.

NS, Non-significant.

the yield of pasture species between seedbed preparation means. The dry matter yield from both the raking and non-treatment plots was significantly higher than that from the burning plots. It was interesting to note that the burning which gave a higher establishment of pasture species than the non-treatment, showed the lowest yield in this experiment. Many research findings

regarding the effects of burning on germination, establishment and controlling competition have been reported, but no burning effects on the yield of surface-sown pasture species have been published. Nevertheless, the reports of Grant *et al.* (1958), and Anderson and Elliott (1957) relative to surface seeding can give some support to the above results. Grant *et al.* mentioned that for surface sowing, burning was not always necessary or desirable, particularly on slopes or small mounds where seeds and manures were liable to be washed off. Anderson and Elliot (1957) described that burned soils were low in organic matter. Under this burning experiment, it appears, therefore, that a large yield reduction from the burning plots is more likely to be by less availability of soil organic matter and much accretion of carbonized plant material following incomplete burning.

There was no evidence of an interaction between seedbed preparation and seeding rate for the yield of pasture species. This is, the increase in yield due to seedbed preparation was not modified by seeding rate.

IV. SUMMARY

An experiment was carried out to determine the effects of seeding rates and seedbed preparations on the establishment and yield of surface-sown pasture species. Establishment of orchardgrass was significantly increased by the lowest seeding rate of 20 kg/ha as compared to 30 and 40 kg/ha, but no differences were found between the seeding rates of ladino clover. Both raking and burning significantly improved the establishment of pasture species in comparison with non-treatment. There was a significant difference between the raking and burning for the establishment of orchardgrass, but no significant difference was found between the two treatments for that of ladino clover.

Increasing seeding rate of pasture species did not enhance the yield of surface-sown pasture, but both the raking and non-treatment significantly increased the yield of pasture species. The results suggest that both the raking and burning can improve the establishment but increasing seeding rate over 20 kg/ha and burning

may not increase the yield.

(Key word: seeding rates, seedbed preparations, seedling establishment, surface-sown pasture species.)

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