GRAZING AND DEFOLIATION EFFECTS ON SEED PRODUCTION AND GERMINATION OF INDIAN RICEGRASS

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ABSTRACT

Studies were conducted in the semi-arid area of southwestern United States to determine effects of long-term grazing and defoliation on seed production characteristics of Indian ricegrass (*Oryzopsis hymenoides*). Long-term heavy grazing did not genetically alter seed production potential of Indian ricegrass. Both Grazed and Ungrazed strains differed significantly in seed production from cultivars Nezpar and Paloma. Defoliation reduced seed production, the greatest reduction resulted from the most severe defoliation intensity. Germination was higher in the field because of natural scarification and prechilling seed experienced during winter. Cultivars had higher germination because of selection for higher seed germination during breeding. Viability was higher for uncultivated strains suggesting a dormancy mechanism significant for long-term survival of the species under harsh conditions.

KEYWORDS

Grazing, defoliation, germination, viability, ricegrass, seed production

INTRODUCTION

Indian ricegrass is a perennial bunch grass which is widely distributed in most of western United States, southern Canada, and Mexico (Booth *et al*., 1980). The grass which grows in early springs is highly palatable and has resisted heavy grazing pressure. It is also important for its wide use in stabilizing soil and revegetating rangelands. Its seed has two types of dormancy inhibiting germination: the water barrier of seed coat and embryo dormancy caused by excessive abscisic acid (MacDonald, 1976). Zemetra and Cuany (1984) reported that seed germination of various strains of Indian ricegrass improved with ageing. Defoliation of plants may result in reduction of flowering and seed production (Roberts, 1958). This study aimed at determining (a) effects of long-term heavy grazing and different defoliation intensities on seed production of Indian ricegrass (b) seed characteristics influencing its long-term survival.

MATERIALS AND METHODS

Seed production. Experiments were conducted at two study sites [Chaco Canyon (New Mexico) and Cortez (Colorado)] located in Southern United States as described by Orodho (1987).

At Chaco Canyon site. Ten plants of Indian ricegrass in natural community were selected at random from each of the six plots located on hill-top, hill-side and swale on each of the two areas (heavily grazed and ungrazed). Seed was harvested from these plants twice weekly throughout their seed production season. Four defoliation intensities (0, 30, 60, 90% removal of photosynthetic tissues) were each applied at anthesis stage to four other Indian ricegrass plants selected at random from the six plots. Seeds was also harvested from these. **At Cortez site** five splits of uniform size were obtained from each of the four strains and cultivars of Indian ricegrass (Grazed, Ungrazed, Paloma, Nezpar) and transplanted in an experiment with two nitrogen (0,50 kg/ha), two defoliation (defoliated, undefoliated) treatments. Nitrogen was applied in early June and seed harvested twice weekly.

Seed germination and viability. Seeds of ten strains and cultivars of Indian ricegrass (six strains each from the six plots described earlier and four cultivars: Napi, Paloma, NM-1449 and Nezpar) were collected, uniformly cleaned, sized and each divided into two portions. One portion was scarified as described by Zemetra (1979), the other was unscarified. Seeds from each portion was further divided into two lots, one lot was prechilled following rules of Association of Official Seed Analyst (AOSA) (1978) and the other lot was unprechilled. Germination tests were carried out in the growth chamber. After 21 days of germination, viability tests using tetrazolium chloride reaction was carried out to identify seed that were viable but dormant. Greenhouse and field germination studies were also carried out on the four lots of seed of the 10 strains and cultivars. All data were analysed using Analysis of variance procedures. Turkey's Test was used to separate significant means.

RESULTS AND DISCUSSION

Seed production. There were no significant differences in seed production of grazed and ungrazed Indian ricegrass. There were also no significant differences in seed yield among the three topographic positions. Seed production of grazed and ungrazed strains did not also differ significantly (Fig 1). This indicates that over 50 years of heavy grazing pressure had not genetically altered seed production potential of Indian ricegrass. Nitrogen application in early June did not increase seed production because moisture was limiting.

The two natural strains: Grazed and Ungrazed differed in seed production from both the cultivated Paloma and Nezpar. Nezpar produced the greatest seed yield of 312 kg/ha, Paloma produced the lowest yield of 78 kg/ha when compared to both Grazed and Ungrazed strains that produced an average yield of 104 kg/ha. This indicates that the natural strains had the potential to produce higher seed than Paloma. These strains can be developed as cultivars for the region. There was greater seed yield produced in 1985 than 1984 mainly because of the higher precipitation received in 1985. Long-term heavy grazing had no effect on seed production under the various defoliation intensities. However, there was progressive decrease in seed yields with an increasing in defoliation intensities (Fig 1).

Seed Germination and Viability. There were significant variations in seed viability among the different strains and cultivars of Indian ricegrass. Most natural strains had higher viability than did the cultivars (Fig 2). Generally there were no significant differences in seed germination among strains. The natural strains had lower seed germination than the improved cultivars (Nezpar, Paloma, NM-1449). Seed germination of natural strain was higher in the field than in either the growth chamber or greenhouse. Seed planted in the field in November, 1984 was subjected and responded well to natural scarification and prechilling from frequent soil freezing and thawing during winter.

The higher viability and lower germination characteristics of the natural strains indicate that natural strains had higher dormancy characteristics than the improved cultivars. Various strains and

cultivars showed variabilities in their response to mechanical scarification. Indian ricegrass has been found to show variabilities in seed weight, size, seed coat thickness, composition of their polymorphic forms and germination (Zemetra (1979), Orodho (1987)). This explains why application of uniform scarification treatment did not increase seed germination percentages uniformly on all strains and cultivars.

SUMMARY AND CONCLUSION

Long-term heavy grazing did not affect the seed production potential of Indian ricegrass. Defoliation at anthesis did reduce seed production, and the greatest reduction resulted from the most severe defoliation intensity. Nitrogen application in early June had no significant effect on seed yield. The two strains from Chaco Canyon showed superiority in seed production over the cultivated Paloma and, therefore, should be developed for their promising characteristics on drought tolerance, resistance to heavy grazing and seed production necessary for grazing and revegetation purposes.

Mechanical scarification did not break dormancy and increase germination of all strains and cultivars probably because of their high variabilities in seed size, weight, and seed coat thickness. Seed viability of natural strains was high while seed germination low suggesting a dormancy mechanism which is of significant biological value for the long-term successful survival of this species under semi-arid conditions.

Efforts to improve germination and reduce dormancy characteristics of the grass should not jeopardise the long-term survival mechanism by rendering the species free of their dormancy traits.

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Figure 1
Grazing and defoliation effects on seed production of Indian ricegrass

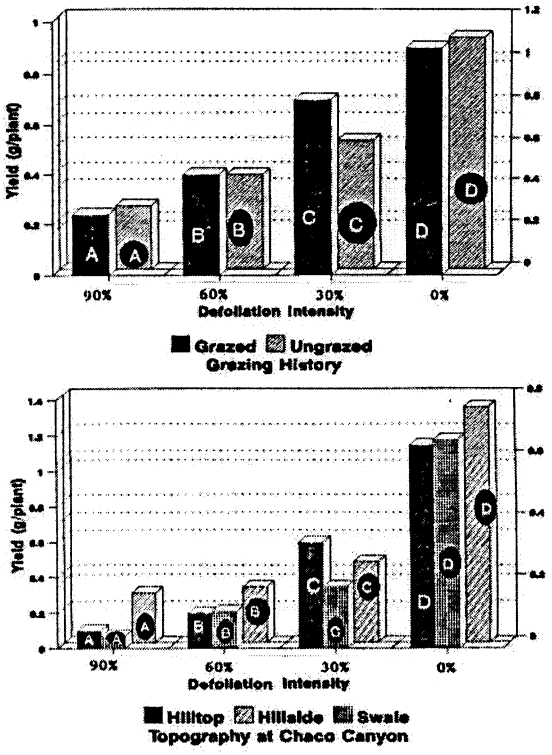

Figure 2
Seed viability and germination of Indian ricegrass