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1975 PROGRESS REPORT

**GROWTH OF PERENNIALS IN RESPONSE TO VARYING
MOISTURE AND DEFOLIATION REGIMES**

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ABSTRACT

A study of the effects of simulated herbivory and supplementary watering on *Atriplex confertifolia* (ATR CON) was begun in June 1974. Overwintered plants had significantly more new growth and leaf weight than treatment plants harvested the previous fall. No significant differences were found in total above-ground weights or root weights of *A. confertifolia* harvested in the fall of 1975. Significant treatment effect was found in analysis of leaf and new wood weights. Litter production was not affected by treatment.

INTRODUCTION

Watering and simulated herbivory studies on *Atriplex confertifolia* (ATR CON) continued during 1975 on the Curlew Valley Validation Site. The experimental design was similar to that used in the first year of the study (MacMahon et al. 1975), with the following objectives: 1) to measure growth response and nutrient composition of ATR CON after supplementary summer water and selective clipping of above-ground phytomass; 2) to determine the effect of different soil moisture regimes on the decomposition of *Atriplex* leaf and stem litter.

METHODS

In 1975, 480 "typical" *Atriplex confertifolia* (as described in Shinn et al. 1975) were tagged as experimental plants on site 3 (*Artemisia tridentata*-*Atriplex confertifolia*-*Sitanton hystrix* vegetation type) on the Curlew Valley Validation Site. Shrubs were randomly assigned to a 3 x 4 matrix of watering and clipping treatments. Watering treatments were: normal (natural rainfall); medium (addition of 2.5 cm per month); heavy (addition of 2.5 cm per week). Clipping treatments were: defoliate (removal of one-half of the leaves); debranch (removal of one-half of the branches to ground level); "denewgrowth" (removal of one-half of the plant's new wood); and control (no clipping).

Overwintered plants and litter bags from 1974 were harvested in June 1975 and new plants were measured and clipped. Watering began July 1. Water applications and treatment of harvested plants have been described previously (MacMahon et al. 1975). Wescor thermocouple psychrometers, calibrated for extreme soil moisture potentials, were installed at 15- and 30-cm depths under five plants of each watering treatment. Readings were taken weekly from July 22 to September 30, 1975.

Thirty additional litter traps (similar to those of West and Fareed 1973) were installed in 1975; thus, litter production by 15 plants of each watering treatment was measured. Litter bags were buried under 75 shrubs and five pairs for each watering treatment were collected monthly during the summer of 1975. The rest remained until spring and summer 1976.

In October 1975, all experimental shrubs were measured and 10 plants of each clipping-watering treatment were harvested. Root samples for harvested shrubs were taken at 0-20 cm and 20-40 cm depths.

RESULTS AND DISCUSSION

By June 1975, overwintered plants had significantly more ($p < 0.01$) new growth and leaf weight than treatment plants harvested in October 1974. March-May rainfall was 126 mm, 122% of "normal." Early spring rains enabled plants to recover from the previous year's clipping and to add new stems up to 15 cm in length.

Summer rainfall totaled 56 mm, five times that of 1974 but still only 85% of the 50-year norm for Snowville. Additional rainfall during the summer of 1975 kept soil moisture under unwatered plants considerably higher than it was in 1974; however, analysis of variance of soil water potentials (Table 1) showed that watering treatments did add significant moisture to soils around experimental shrubs (DSCODE A3UMJ01). The mean value for the heavy watering treatment (-34.8 bars) was significantly higher ($p < 0.01$) than the mean for medium watering (-43.47 bars) and normal conditions (-41.34 bars).

There were no significant differences ($p > 0.05$) found in the total above-ground weights or root weights of *Atriplex* harvested in the fall of 1975 (A3UMJ02). However, analysis of leaf and new wood weights (Tables 2 and 3) revealed treatment effects.

Tables 4 and 5 present Newman-Keuls' multiple range test results for mean new wood and leaf weights. Overlapping similarities suggest that sample sizes were inadequate to clearly separate means. Weekly watering caused experimental shrubs to grow throughout the summer, but water addition once a month did not.

Litter production did not vary significantly ($p > 0.05$) with watering treatments; variance was more than 300% of the mean for some weeks and watering regimes (A3UBJD5).

Preliminary chemical analysis results (A3UMJ03) indicated that there were significant ($p < 0.05$) differences in caloric content of certain plant parts from different clipping treatments. The breakdown of chemical analysis instruments has further postponed our reporting of complete nutrient analysis.

EXPECTATIONS

We plan to harvest some experimental shrubs in the spring of 1976 and to continue watering remaining plants throughout the summer, the last field season for this process study. Final harvest will take place in the fall.

When chemical analysis of samples from at least 1974 and 1975 is complete, we can begin to examine variation in nutrient composition in response to clipping and/or watering. Litter bag decomposition rates will also be calculated for the final report.

Table 1. Analysis of variance of soil water potential during summer 1975

Source variation	d.f.	S.S.	M.S.	F
treatment	2	4465.43	2232.72	41.45**
time	10	35299.60	3529.96	65.53**
depth	1	3.92	3.92	0.07
ti X tr	20	942.08	47.10	0.87
ti X d	10	464.10	46.41	0.86
tr X d	2	245.51	122.75	2.28
tr X ti X d	20	611.70	30.58	0.57
error	264	14220.14	53.86	

** sig. $p < 0.01$

Table 2. Analysis of variance of *Atriplex* leaf weights, 1975

Source variation	d.f.	S.S.	M.S.	F
clipping	3	383.63	127.88	3.39*
water	2	293.09	146.55	3.88*
clip X water	6	137.92	22.99	0.69
error	108	4077.43	37.75	

* sig. $p < 0.05$

Table 3. Analysis of variance of *Atriplex* new wood weights, 1975

Source variation	d.f.	S.S.	M.S.	F
clipping	3	274.92	91.64	18.21**
water	2	55.59	27.79	5.52**
clip X water	6	21.88	3.65	0.72
error	108	543.45	5.03	

** sig. $p < 0.01$

Table 4. Mean leaf weights for treated *Atriplex* (g/plant)

Clipping treatments			
13.21	15.15	17.22	17.71
control	deneugrowth	defoliate	debranch *
Watering treatments			
13.99	15.67	17.81	
medium	normal	heavy *	

* sig. $p < 0.05$

Table 5. Mean new wood weights for treated *Atriplex* (g/plant)

Clipping treatments			
3.85	6.39	7.20	7.83
deneugrowth	defoliate	debranch	control *
Watering treatments			
5.66	6.04	7.36	
medium	normal	heavy *	

* sig. $p < 0.05$

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