

AN ABSTRACT OF THE THESIS OF

Jean Ann Gleichsner for the degree of Master of Science
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Title: Germination and Growth Characteristics of Five
Accessions of Jointed Goatgrass
(*Aegilops cylindrica*)

Redacted for privacy

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Arnold P. Appleby

Laboratory and field studies were conducted at Pendleton, Oregon, during 1983 and 1984 to evaluate germination and growth characteristics of five jointed goatgrass (*Aegilops cylindrica* Host) accessions collected from sites in Echo, Ione, Pendleton, Condon, and Elgin, Oregon. Spikelets were germinated for 27 days at room (23 ± 2 C) and constant (7, 18, 23, 29, and 38 C) temperatures after storage for 0 to 12 months. The germination pattern for jointed goatgrass spikelets was similar for all accessions. Highest germination occurred at either 18 or 23 C for all storage lengths, except for 12-months-old spikelets, which germinated best at 29 C. Freshly harvested spikelets (0-months-old) were predominantly dormant at high temperatures, but some germination occurred at lower temperatures (7 and 18 C). As storage time increased,

spikelets afterripened (lost their dormancy) and gained the ability to respond to a wider range of temperatures. At the same time, germination rate and percentage generally increased as the temperature was raised from 7 to 29 C. No germination occurred at 38 C.

Emergence and flowering times in the field were similar for all accessions. Jointed goatgrass from Condon was significantly taller and produced fewer spikelets per spike than the other accessions. Spikelet yield and stand counts differed among accessions, but this may have been due to spikelet quality differences at planting. No significant differences were observed for leaf and stem dry weight, spikes per plant, and spikelets per plant.

Data suggest that the five jointed goatgrass accessions may be genetically similar, thus control programs may not need to be site specific. Definite conclusions on genetic similarity must await second-generation studies of plants grown from seed produced under the same environmental conditions.

Germination and Growth Characteristics of Five Accessions of
Jointed Goatgrass (Aegilops cylindrica).

by

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Professor of Crop Science ~~In~~/charge of ~~of~~ major

Redacted for privacy

Head of Department, Crop Science

Redacted for privacy

Dean of Graduate School

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Germination and Growth Characteristics of Five
Accessions of Jointed Goatgrass (Aegilops cylindrica)

INTRODUCTION

Jointed goatgrass (Aegilops cylindrica Host¹), a winter annual grass, has become a major weed problem in the winter wheat (Triticum aestivum L.)-producing areas of the United States. Jointed goatgrass not only infests wheat fields, but also can be found along roadsides, waste areas, and grasslands.

Jointed goatgrass reduces winter wheat yields by competing for moisture, soil nutrients, and sunlight. Winter wheat grain contaminated with jointed goatgrass seed is subject to dockage at the elevator. Thus, jointed goatgrass reduces both wheat yield and quality.

Genetically related, jointed goatgrass and winter wheat are similar in vegetative and reproductive growth habits. Consequently, no effective herbicides exist for selective jointed goatgrass control in winter wheat. At present, the most effective control methods include a combination of preventive (weed-free crop seed), cultural (spring crop rotation), and mechanical (tillage prior to fall seeding of wheat) practices. However, these weed-control techniques are not always effective or economically feasible. A better

¹Known also as Triticum cylindricum Ces., Pass., and Gib.

understanding of the biology of jointed goatgrass may suggest more effective and economical control strategies.

Research in Chapter 1 was undertaken to evaluate the effect of temperature and storage length on the germination of five (Echo, Ione, Pendleton, Condon, and Elgin) jointed goatgrass accessions collected in Oregon. Chapter 2 compared growth and morphological characteristics of the five jointed goatgrass accessions.

Chapter 1. Effect of temperature and storage length on the germination of five accessions of jointed goatgrass (Aegilops cylindrica) from eastern and north-central Oregon.

Abstract. Five jointed goatgrass (Aegilops cylindrica Host) accessions were collected from sites in Echo, Ione, Pendleton, Condon, and Elgin, Oregon. Spikelets were germinated for 27 days at room (23 ± 2 C) and constant (7, 18, 23, 29, and 38 C) temperatures after storage for 0 to 12 months. The germination pattern of jointed goatgrass spikelets was similar for all accessions. Highest germination occurred at 18 or 23 C for all storage lengths, except for 12-months-old spikelets, which germinated best at 29 C. Freshly harvested spikelets (0-months-old) were predominantly dormant at high temperatures, but some germination occurred at lower temperatures (7 and 18 C). As storage time increased, spikelets afterripened (lost their dormancy) and gained the ability to respond to a wider range of temperatures. At the same time, germination rate and percentage generally increased within a storage length as the temperature was raised from 7 to 29 C. No germination occurred at 38 C.

INTRODUCTION

Jointed goatgrass has become a serious weed problem in the winter wheat producing areas of the Pacific Northwest (13, 14). This winter annual grass occurs in wheat fields, grasslands, waste areas, and along roadsides (7).

Jointed goatgrass competes with winter wheat for moisture, nutrients, and sunlight, causing reduced grain yields (4, 6, 12, 13). Similarities in seedhead position and maturation make contamination of wheat seed unavoidable and conventional seed cleaning methods are not completely effective (3). Thus, jointed goatgrass reduces both wheat yield and quality.

Jointed goatgrass and winter wheat are similar in vegetative and reproductive growth habits; however, seedheads of the two are distinctly different (3). Jointed goatgrass produces a tight cylindrical spike in which each spikelet contains two to five flowers. At maturity, the spike disarticulates either between spikelets or near the base of the spike (5, 7).

Genetically related, jointed goatgrass ($2n=28$; CCDD) and wheat ($2n=42$; AABBDD) share the D genome (8, 11). Crosses formed between the two produce either sterile or no seed (9). Because of this close genetic relationship, chemical methods for selective control of jointed goatgrass in winter wheat have been unsuccessful (1, 2, 15).

Therefore, a better understanding of the biology of jointed goatgrass may suggest control strategies.

Germination studies conducted by Morrow et al. (12) found that jointed goatgrass germinated at temperatures ranging from 10 to 35 C. No difference in percent germination of 1-yr-old or freshly harvested spikelets existed between 10, 15, or 20 C. The objective of this study was to obtain additional information on the effect of temperature and storage length on the germination of five (Echo, Ione, Pendleton, Condon, and Elgin) jointed goatgrass accessions collected in Oregon.

MATERIALS AND METHODS

Mature jointed goatgrass spikelets were collected from five locations in eastern and north-central Oregon during July and August, 1983 (Table 1.1). Spikelets were hand-cleaned, and distal and proximal spikelets of each spike were discarded. Remaining spikelets were stored in paper bags in the laboratory (23 ± 2 C). Germination experiments were started soon after the collection date, and the spikelets were considered to be 0 months old at the start of the experiment. Germination responses were determined in dark germination chambers when the spikelets were 0, 0.5, 1, 2, 3, 4, and 12 months old. Four constant (± 1 C) temperatures (7, 18, 29, and 38 C) and room temperature (23 ± 2 C) were used.

Germination percentages were determined in petri dishes on two sheets of filter paper moistened with distilled water; more water was added during an experiment to keep the filter paper and spikelets moist. In all tests, four replications of 100 spikelets each were used. Spikelets were surface-sterilized in 0.4% sodium hypochlorite solution to prevent fungal growth. Beginning at 3 days, and at 2-day intervals for a total of 27 days, spikelets were examined in the light at room temperature and considered germinated when a single radicle was visible outside the spikelet. Germinated spikelets were counted and removed from the petri dish. Germination rate (speed of germination) was

calculated by adapting Maguire's (10) formula, in which the number of spikelets producing normal radicles is divided by the number of days elapsed at each count. These proportions were summed. The maximum attainable germination rate was 33.3 (100% germination in the first 3 days).

All experiments were conducted in a completely randomized design with a five (temperatures) by seven (storage periods) factorial arrangement of treatments. Percent germination data was transformed (the arcsin percentage transformation). Analysis of variance was conducted separately for each collection site, and means were separated by Duncan's multiple range test at the 0.05 level of probability.

RESULTS AND DISCUSSION

The germination pattern of jointed goatgrass spikelets was similar for all accessions (Figure 1.1-1.5.). Jointed goatgrass spikelets germinated at temperatures ranging from 7 to 29 C. Highest germination occurred at either 18 or 23 C for all storage lengths, except for 12-months-old spikelets, which germinated best at 29 C. No germination occurred at 38 C (data not shown). Morrow et al. (12) reported very low germination at 35 C (2%).

Freshly harvested (0-months-old) jointed goatgrass spikelets germinated predominantly at the lower temperatures (7 and 18 C), while little or no germination occurred at the higher temperatures (23 and 29 C). As storage time increased, spikelets afterripened (lost their dormancy) and gained the ability to respond to a wider range of temperatures (7-18 C for freshly harvested to 7-29 C for 12-months-old spikelets). At the same time, germination rate and percentage generally increased within a storage length as the temperature was raised from 7 to 29 C (Table 1.2-1.3).

Jointed goatgrass spikelets are shed during July and early August, and germinate mostly in October and November. Germination during the summer seems to be prevented by high temperatures. As the summer proceeds, high-temperature dormancy is gradually lost (afterripening) and spikelets respond to a wider range of temperatures. During October

and November with the decrease in temperature and the continued change of the spikelet's temperature response, there is overlapping between the environmental temperature and the temperature required for germination, and the spikelets germinate. Thus, afterripening renders jointed goatgrass capable of rapid germination at temperatures characteristic of its habitat in October and November.

Delay in germination (dormancy) is especially critical for the year-to-year survival of annual species in a given locality. Afterripening is an adaptation that allows jointed goatgrass to survive an unfavorable season (hot, dry summer) until the more favorable temperatures of fall. Thus, control programs must be planned so that chemical or mechanical control treatments are delayed until the fall.

Table 1.1. Jointed goatgrass collection sites in eastern and north-central Oregon, 1983.

Collection site	County	Collection date	Elevation	Annual precipitation
		(1983)	(m)	(mm)
Echo	Umatilla	July 5	180	300-380
Ione	Morrow	July 7	650	300-350
Pendleton	Umatilla	July 13	450	500-580
Condon	Gilliam	July 19	860	350-460
Elgin	Union	August 2	800	630-730

Table 1.2. Influence of temperature and storage length on germination rate of five accessions of jointed goatgrass^a.

Accession	Germination temperature ^b (C)	Storage length (mo.)						
		0	0.5	1	2	3	4	12
Echo ^c	7	1.5 f-i	2.7 e-i	1.9 e-i	3.0 e-i	1.7 f-i	2.2 e-i	2.5 e-i
	18	1.1 f-i	3.6 d-h	0.9 f-i	8.5 bc	4.2 d-f	6.7 cd	5.1 de
	23	0.2 h-i	0.4 g-i	0.1 i	8.7 bc	3.8 d-g	8.2 bc	11.1 b
	29	0.0 i	0.0 i	0.0 i	1.3 f-i	0.5 g-i	3.2 e-i	17.6 ab
Ione	7	0.6 g-h	3.6 d-f	0.9 f-h	1.8 e-h	1.1 f-h	0.7 gh	1.4 f-h
	18	0.5 g-h	5.1 d	0.5 gh	4.7 d	5.4 d	4.3 de	10.8 b
	23	0.3 h	1.0 f-h	0.2 h	5.6 d	8.0 c	4.8 d	19.4 a
	29	0.0 i	0.1 h	0.1 h	0.7 g-h	3.2 d-g	1.6 f-h	20.1 a
Pendleton	7	0.8 f	1.1 f	1.2 f	1.9 f	1.8 f	2.3 f	1.5 f
	18	0.6 f	0.6 f	6.4 d	7.4 cd	7.7 cd	6.1 d	7.9 cd
	23	0.0 f	0.1 f	1.5 f	6.5 cd	8.3 cd	9.7 c	14.8 b
	29	0.0 f	0.0 f	0.2 f	0.9 fij	2.9 ef	5.7 de	19.1 a
Condon	7	0.3 de	0.6 c-e	2.0 b-e	1.4 b-e	0.4 de	0.3 de	0.4 de
	18	0.0 eg	0.2 de	4.2 b-d	3.6 b-e	4.5 bc	4.6 bc	5.4 b
	23	0.0 e	0.0 e	0.2 de	4.9 b	5.0 b	3.6 b-e	7.4 a
	29	0.0 e	0.0 e	0.0 e	0.1 e	0.3 de	1.8 b-e	9.3 a
Elgin	7	0.5 fg	2.6 b-g	2.2 c-g	0.9 e-g	1.7 d-g	1.3 d-g	0.5 fg
	18	0.1 g	1.6 d-g	3.6 b-f	0.7 fg	4.2 b-e	2.0 d-g	5.4 bc
	23	0.0 g	0.9 e-g	4.7 b-d	2.0 d-g	5.7 b	1.8 d-g	7.7 b
	29	0.0 g	0.1 g	0.0 g	0.1 g	1.9 d-g	2.5 b-g	13.1 a

^aGermination rate = $\frac{\text{number of normal seedlings}}{\text{days to first count}} + \dots + \frac{\text{number of normal seedlings}}{\text{days to final count}}$

^bNo germination occurred at 38 C. Data not shown.

^cMeans within an accession followed by the same letter are not significantly different at the 0.05 level of probability as determined by Duncan's multiple range test.

Table 1.3. Influence of temperature and storage length on the percent germination of jointed goatgrass accessions.

Accession	Germination temperature ^a	Storage length (mo.)						
		0	0.5	1	2	3	4	12
	(C)	(% germination ^b)						
Echo	7	28.0 f-h	43.5 c-f	33.8 d-g	57.0 bc	32.3 e-f	42.0 c-f	51.8 b-d
	18	14.3 h-j	28.5 f-h	13.0 ij	77.8 a	35.0 d-g	50.5 d-g	38.3 c-g
	23	2.5 kl	7.3 jk	1.8 kl	75.8 a	33.5 d-g	57.0 d-g	44.3 c-f
	29	0.0 l	0.0 l	0.0 l	21.3 g-i	3.5 k	28.5 f-h	65.8 ab
Ione	7	12.3 f-i	54.3 a-d	17.3 fg	35.8 d-e	23.3 ef	14.0 f-h	27.5 ef
	18	8.3 g-j	48.0 b-d	7.5 g-j	48.8 b-d	47.5 b-d	35.3 de	52.0 a-d
	23	4.8 h-k	16.5 fg	3.5 i-k	55.8 a-c	62.8 ab	38.3 c-e	64.0 ab
	29	0.3 k	1.5 j-k	1.3 j-k	12.0 f-i	24.8 ef	15.0 f-h	68.3 a
Pendleton	7	15.3 h-j	19.3 g-i	21.5 f-j	34.8 d-g	34.5 d-g	36.3 c-g	30.3 e-h
	18	8.5 jk	9.3 jk	55.8 ab	56.5 ab	50.8 a-d	38.8 b-f	33.8 d-g
	23	0.0 l	1.3 l	28.8 f-i	48.8 a-d	53.0 a-d	54.8 a-c	50.0 a-d
	29	0.3 l	0.3	3.3 kl	14.5 ij	24.0 f-i	47.8 b-e	67.5 a
Condon	7	6.3 e	10.8 de	39.0 b	27.0 bc	9.3 de	5.8 e	9.5 de
	18	0.0 g	3.8 ef	57.0 a	36.3 b	30.3 bc	34.8 bc	25.8 bc
	23	0.3 fg	0.3 fg	3.5 e-g	40.3 b	33.8 bc	24.0 bc	27.0 bc
	29	0.0 g	0.0 g	0.0 g	2.0 e-g	2.8 e-g	19.0 e-d	34.8 b
Elgin	7	9.5 j-l	49.8 ab	42.5 a-d	17.0 g-k	32.3 b-h	24.8 c-j	10.3 i-l
	18	1.3 lm	33.0 b-h	45.8 a-c	7.5 kl	35.5 b-g	14.8 h-k	25.5 c-j
	23	0.3 m	20.5 e-k	61.5 a	21.0 d-k	39.8 a-f	19.0 f-k	28.0 b-i
	29	0.0 m	2.5 lm	0.3 m	1.5 lm	21.8 d-k	25.3 c-j	42.0 a-e

^aNo germination occurred at 38 C. Data not shown.

^bMeans within accessions followed by the same letter are not significantly different at the 0.05 level of probability as determined by Duncan's multiple range test.

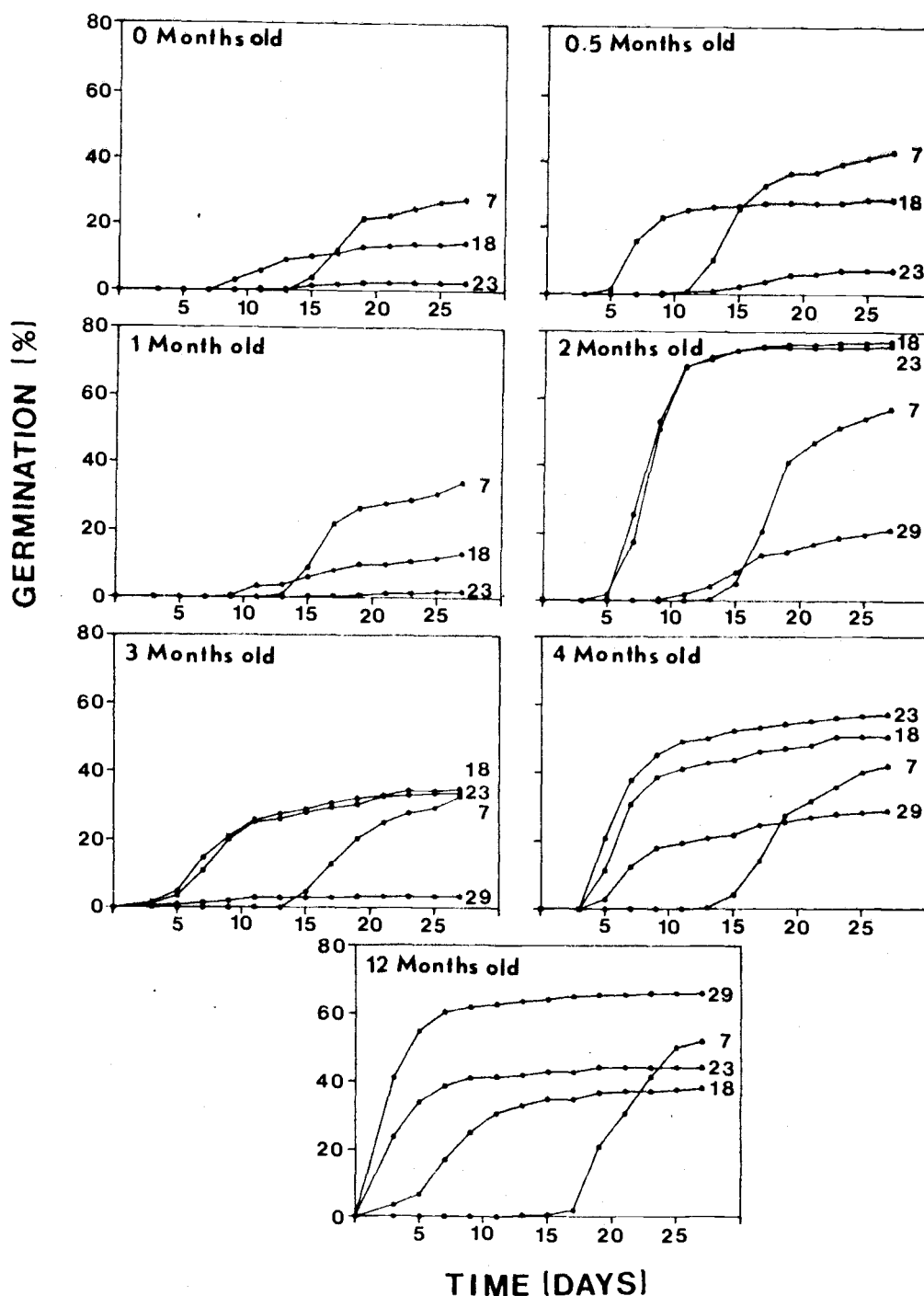


Figure 1.1. Influence of temperature (7, 18, 23, 29, and 38 °C) and storage length (0, 0.5, 1, 2, 3, 4, and 12 months) on germination of jointed goatgrass spikelets collected from Echo, Oregon. No germination occurred at temperatures not shown.

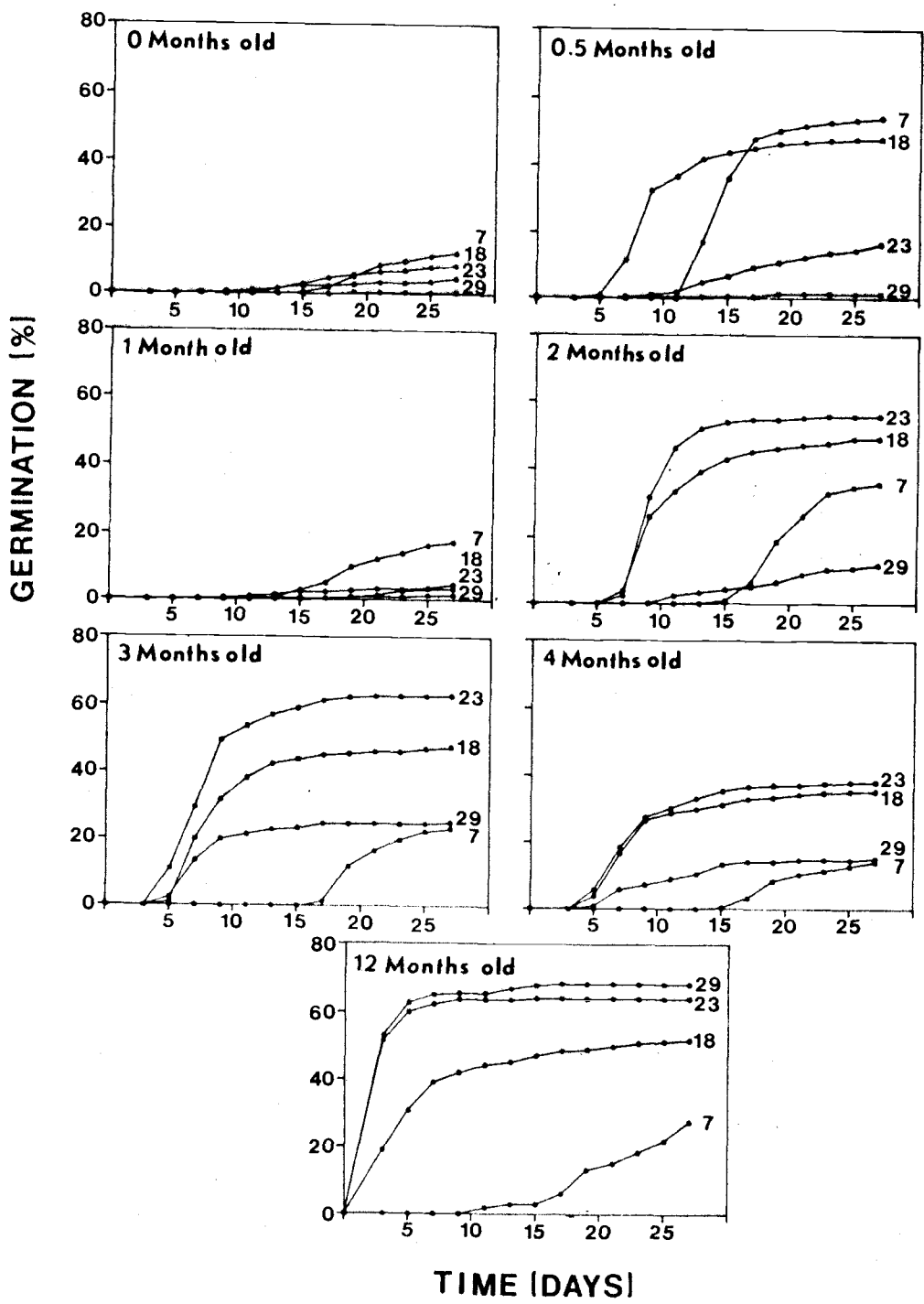


Figure 1.2. Influence of temperature (7, 18, 23, 29, and 38 C) and storage length (0, 0.5, 1, 2, 3, 4, and 12 months) on germination of jointed goatgrass spikelets collected from Ione, Oregon. No germination occurred at temperatures not shown.

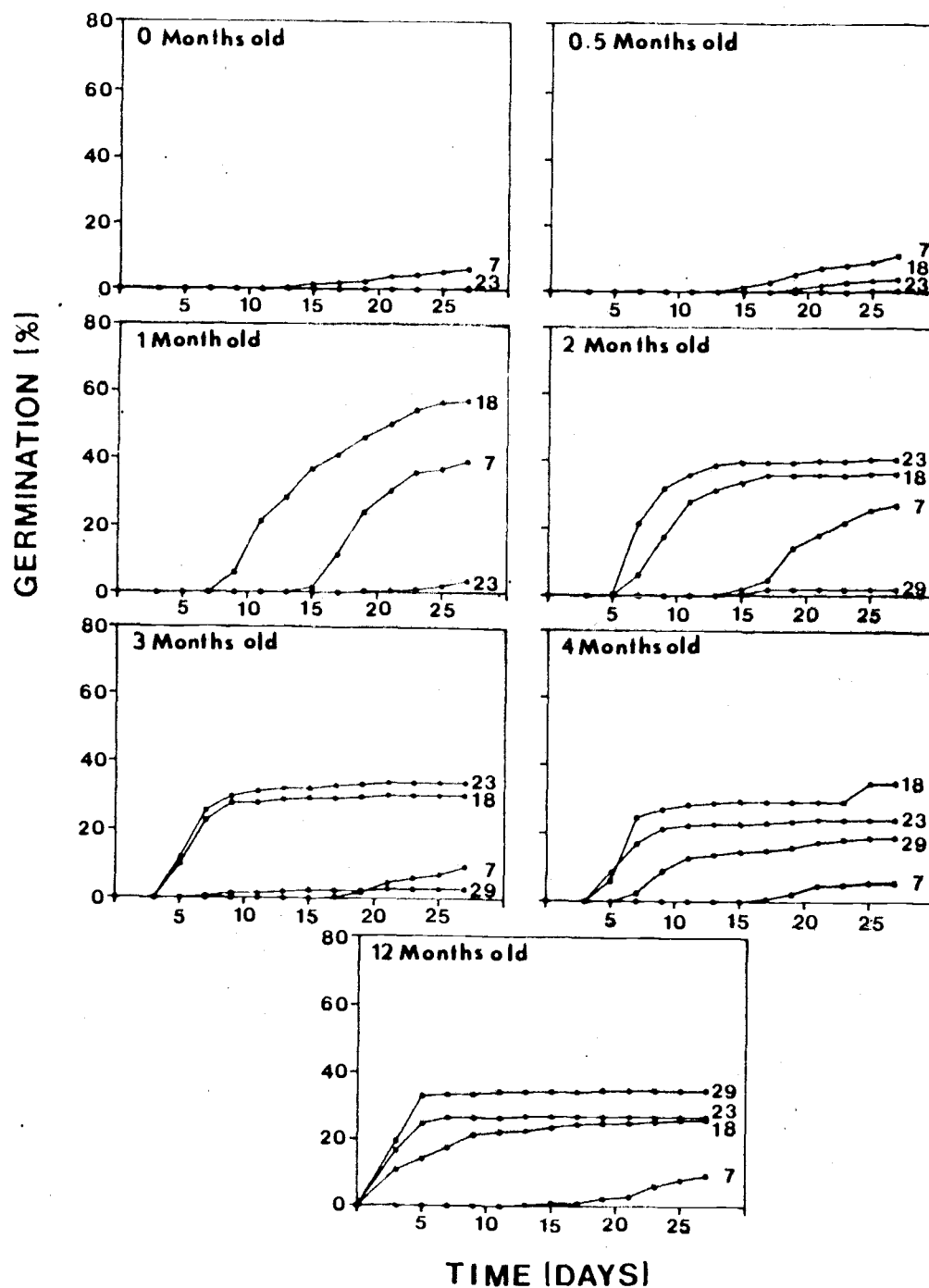


Figure 1.3. Influence of temperature (7, 18, 23, 29, and 38 C) and storage length (0, 0.5, 1, 2, 3, 4, and 12 months) on germination of jointed goatgrass spikelets collected from Condon, Oregon. No germination occurred at temperatures not shown.

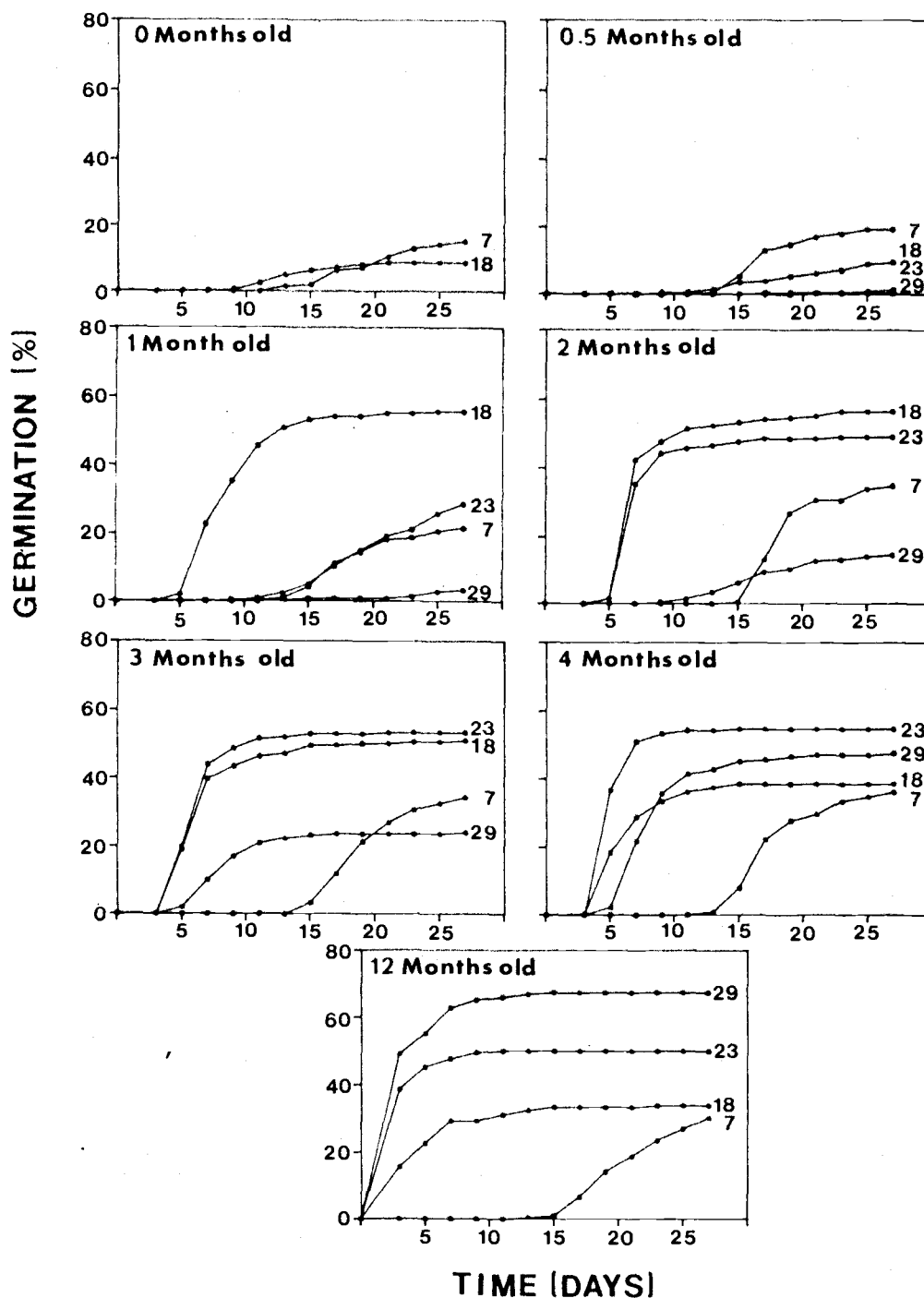


Figure 1.4. Influence of temperature (7, 18, 23, 29, and 38 C) and storage length (0, 0.5, 1, 2, 3, 4, and 12 months) on germination of jointed goatgrass spikelets collected from Pendleton, Oregon. No germination occurred at temperatures not shown.

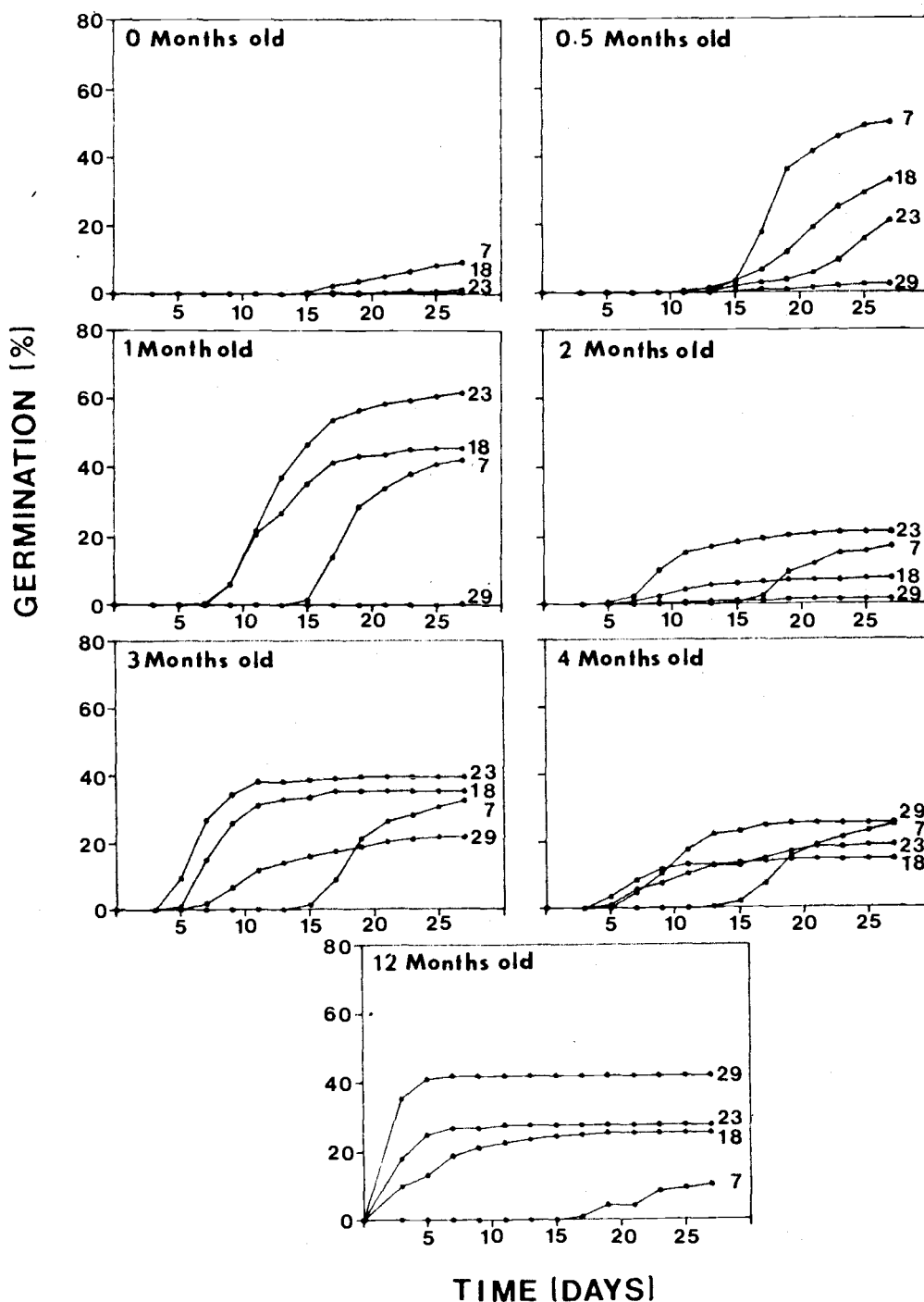


Figure 1.5. Influence of temperature (7, 18, 23, 29, and 38 C) and storage length (0, 0.5, 1, 2, 3, 4, and 12 months) on germination of jointed goatgrass spikelets collected from Elgin, Oregon. No germination occurred at temperatures not shown.

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Chapter 2. Growth and morphological characteristics of five accessions of jointed goatgrass (Aegilops cylindrica) from eastern and north-central Oregon

Abstract. A field study was conducted at Pendleton, Oregon, during 1983 to 1984 to evaluate growth and morphological characteristics of jointed goatgrass (Aegilops cylindrica Host) accessions collected from five sites in eastern and north-central Oregon, and grown at Pendleton. Emergence and flowering times were similar for all accessions. Jointed goatgrass from Condon was significantly taller and produced fewer spikelets per spike than the other accessions. All accessions were highly susceptible to lodging and stripe rust (Puccinia striiformis West.) infection. Spikelet yield and stand counts differed among accessions, but this may have been due to spikelet quality differences at planting. No significant differences were observed for leaf and stem dry weight, spikes per plant, and spikelets per plant.

INTRODUCTION

Jointed goatgrass is a winter-annual grass prevalent in the winter wheat (Triticum aestivum L.)-producing areas of the Pacific Northwest (7, 12) and the central Great Plains (2, 4, 10), particularly where conservation tillage is practiced (10). Although primarily found in wheat fields, jointed goatgrass also occurs along roadsides, in grasslands, and other disturbed areas (5, 7).

Jointed goatgrass competes with winter wheat for moisture, nutrients, and sunlight, causing reduced grain yields (4, 6, 11, 12). Similarities in seedhead position and maturation make contamination of wheat seed unavoidable (3). Thus, jointed goatgrass reduces quality as well as yield.

Jointed goatgrass and winter wheat are genetically related (8, 9). Consequently, attempts to selectively control jointed goatgrass in winter wheat with herbicides have proved unsuccessful (1, 2). A better understanding of the biology of jointed goatgrass may suggest control strategies.

The objective of this research was to obtain information on growth and morphological characteristics of jointed goatgrass from various origins when grown in a uniform environment. By eliminating the effects of differences in the environment on the phenotype, the genotypes of different accessions may be compared directly.

MATERIALS AND METHODS

Mature jointed goatgrass spikelets were collected from five sites in eastern and north-central Oregon during July and August, 1983 (Table 2.1). Spikelets were hand-cleaned, and the distal and proximal spikelets of each spike were discarded. Weight per spikelet was determined for each accession. A field study was established at Columbia Basin Agricultural Research Center, Pendleton, Oregon, on October 12, 1983. The soil was a Walla Walla silt loam (coarse-silty, mixed, mesic Typic Haploxeroll), pH 6.5, and 1.9% organic matter. Nitrogen fertilizer was broadcast on the soil surface at 67 kg/ha. Jointed goatgrass spikelets from each site were hand-planted 3.8 cm deep at 2.5-cm intervals with a 7.1-cm row spacing. Plot size was 1.8 m by 3.7 m. Broadleaf weeds were controlled in early March with bromoxynil (3,5-dibromo-4-hydroxybenzonitrile) + MCPA [(4-chloro-2-methylphenoxy)acetic acid] at 0.4 + 0.4 kg ai/ha in 187 L/ha of water. Several hand-weedings were necessary to remove downy brome (Bromus tectorum L.). Plots were treated in mid June with triadimefon [1-(4-chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanone] at 0.3 kg ai/ha in water at 187 L/ha to control stripe rust.

Measurements. Seedlings were counted on November 22, 1983, when jointed goatgrass was in the two-leaf stage. At anthesis, samples were harvested from the north border row of each plot on June 22, 1984, to measure leaf and stem dry

weight. Samples were oven dried at 43 C for 5 days. Visual evaluations of lodging and stripe rust infection also were made at that time. Parameters measured before harvest include: a) plants per meter of row, b) spikes per plant, c) spikelets per spike, and d) plant height (cm).

Measurements were made on 1 m of row in approximately the same relative position in each plot. Plant height was measured on every fourth plant in the meter of row and averaged for the plot. Jointed goatgrass plants (straw and spikelets) were hand-harvested at maturity (July 1984) from 1 m of two center rows of each four-row plot. Samples were air dried for 6 days, machine threshed, hand-cleaned, and weighed. Weight per spikelet was determined for each accession. A randomized complete block design with four replications was used. Data were analyzed by analysis of variance and means were separated by Duncan's multiple range test at the 0.05 level of probability.

RESULTS AND DISCUSSION

Emergence. All jointed goatgrass accessions emerged approximately 2 weeks after planting.

Stand count. At the two-leaf stage, all jointed goatgrass accessions except Condon had a higher stand count than Echo (Table 2.2). Stand count differences among accessions may be partially attributed to spikelet quality (Table 2.3). At planting, jointed goatgrass from Echo had the lowest spikelet weight. Echo spikelets averaged 93% lighter than all other accessions. Echo seedlings appeared less vigorous, with spindlier stems and narrower leaves.

Both Elgin and Condon had the heaviest spikelet weight; however, stand counts differed between the two accessions. Elgin produced the highest stand count, while Condon one of the lowest. Therefore spikelet quality cannot entirely account for differences in stand count.

Leaf and stem weight. At anthesis, aboveground dry weight did not differ significantly among accessions (Table 2.2). Jointed goatgrass, like wheat, has the ability to tiller which can compensate for either a poor initial stand or early season injury.

Lodging and stripe rust infection. All accessions were highly susceptible to lodging and stripe rust infection (data not shown).

Plants per meter. At harvest, differences in plant stand among accessions were not as evident as at the two-leaf

stage (Table 2.2). From two-leaf to harvest, plant numbers in all accessions decreased, losses ranged from 33% for Ione to 21% for Condon. A decrease in plant number may be attributed to competition (intra- and interspecific), and winter injury.

Spikelet production. No significant differences were observed among accessions for spikes per plant (Table 2.2). Variation within some accessions was large, making detection of differences among accessions difficult. Condon produced fewer spikelets per spike than all other accessions.

Spikelets per plant was mathematically derived by multiplying spikes per plant by spikelets per spike. Therefore, Echo with both a high number of spikes per plant and spikelets per spike had a greater spikelet yield per plant than other accessions. Although the number of spikelets per plant did not differ significantly among accessions, spikelets per plant ranged from 262 for Echo to 172 for Pendleton.

At harvest, Condon had a significantly heavier spikelet weight than any other accessions, except Echo (Table 2.3). Spikelets from Echo were more than twice the weight of the spikelets planted for that accession.

Plant height. At harvest, plants from Condon were taller than all other accessions (Table 2.2). Height differences between Condon and the other accessions may be attributed to differences in time of flowering. Severe lodging of all accessions before heading, however, made determination of a

50% heading date extremely difficult. Therefore, differences in flowering times, if present, were not observed.

Yield Components. Total yield (straw and spikelet) did not differ significantly among accessions, but partitioning of dry matter between the two components did (Table 2.4). Echo produced the least straw of all accessions, but had the highest spikelet yield. In contrast, Condon with the highest straw yield produced the lowest spikelet yield. Thus, high straw yield was associated with low spikelet yield, and low straw yield with high spikelet yield.

Harvest index, a measure of reproductive efficiency, differed among accessions. Echo was the most efficient and Condon the least. Generally, harvest index decreased with increased total yield.

Several characteristics (plant height and spikelets per spike) of the Condon accession are significantly different from all other accessions. These differences, however, may be the result of environmental conditions on spikelet development at the various sites before collection and not because of actual genetic differences among accessions. Additional studies on the spikelets produced under uniform environmental conditions for each accession are underway to confirm this belief. If the accessions are indeed genetically similar, control programs may not need to be site specific.

Table 2.1. Jointed goatgrass collection sites in eastern and north-central Oregon, 1983.

Collection site	County	Collection date	Elevation	Annual precipitation
		(1983)	(m)	(mm)
Echo	Umatilla	July 5	180	300-380
Ione	Morrow	July 7	650	300-350
Pendleton	Umatilla	July 13	450	500-580
Condon	Gilliam	July 19	860	350-460
Elgin	Union	August 2	800	630-730

Table 2.2. Growth characteristics of five accessions of jointed goatgrass from eastern and north-central Oregon grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.^a

Collection site	Stand count per meter (two-leaf)	Leaf and stem dry weight (anthesis)	Plants per meter (harvest)	Spikes per plant	Spikelets per spike	Spikelets per plant	Plant height
	(no.)	(g)	----- (no.) -----				(cm)
Echo	30 d	310 a	21 b	31 a	8.4 a	262 a	68 b
Ione	40 ab	370 a	27 a	27 a	8.4 a	229 a	70 b
Pendleton	37 bc	380 a	29 a	21 a	8.2 a	172 a	72 b
Condon	33 cd	370 a	26 a	28 a	7.8 b	219 a	78 a
Elgin	43 a	380 a	30 a	23 a	8.2 a	192 a	71 b

^aMeans in columns followed by the same letter are not significantly different at the 0.05 level of probability as determined by Duncan's multiple range test.

Table 2.3. Weight per spikelet for five accessions of jointed goatgrass collected from eastern and north-central Oregon sites in 1983, and for jointed goatgrass accessions collected from eastern and north-central Oregon sites and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon during 1983 to 1984^a.

Collection site	Weight per spikelet	
	1983	1984
	----- (mg) -----	
Echo	23.3 d	48.5 a
Ione	34.3 c	42.4 b
Pendleton	45.1 b	43.2 b
Condon	50.4 a	50.1 a
Elgin	50.4 a	42.0 b

^aMeans in columns followed by the same letter are not significantly different at the 0.05 level of probability as determined by Duncan's multiple range test.

Table 2.4. Yield components of five accessions of jointed goatgrass from eastern and north-central Oregon grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984^a.

Collection site	Total yield (straw and spikelet)	Straw yield	Spikelet yield	Harvest index ^b
	----- (kg/ha) -----			(%)
Echo	4330 a	2420 b	1910 a	44.1 a
Ione	4730 a	2850 a	1880 a	39.7 b
Pendleton	4630 a	2980 a	1650 b	35.6 cd
Condon	4650 a	3040 a	1610 b	34.6 d
Elgin	4570 a	2850 a	1720 ab	37.6 c

^aMeans in columns followed by the same letter are not significantly different at the 0.05 level of probability as determined by Duncan's multiple range test.

^bHarvest index = $\frac{\text{units of spikelets}}{\text{units of total yield}} \times 100$

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APPENDIX

Appendix Table 1. Germination percentages for 0-months-old jointed goatgrass spikelets collected from Echo on July 5, 1983. Germination experiments started July 9, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 12	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 14	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 16	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 18	0	0	0	0	0.00	0.00	5	1	4	2	3.00	3.00
July 20	0	0	0	0	0.00	0.00	3	5	1	2	2.75	5.75
July 22	0	0	0	0	0.00	0.00	6	4	1	1	3.00	8.75
July 24	4	5	6	1	4.00	4.00	1	3	1	0	1.25	10.00
July 26	9	11	9	2	7.75	11.75	1	0	2	1	1.00	11.00
July 28	13	9	8	9	9.75	21.50	3	0	2	1	1.50	12.50
July 30	1	1	1	1	1.00	22.50	2	0	1	0	0.75	13.25
Aug. 1	3	3	1	3	2.50	25.00	0	1	0	0	0.25	13.50
Aug. 3	2	5	0	0	1.75	26.75	0	0	1	0	0.25	13.75
Aug. 5	0	1	0	4	1.25	28.00	1	0	1	0	0.50	14.25
Total	32	35	25	20	28.00	28.00	22	14	14	7	14.25	14.25

(continued)

Appendix Table 1. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 12	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 14	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 16	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 18	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 20	1	0	0	0	0.25	0.25	0	0	0	0	0.00	0.00
July 22	1	0	0	0	0.25	0.50	0	0	0	0	0.00	0.00
July 24	2	1	0	1	1.00	1.50	0	0	0	0	0.00	0.00
July 26	0	0	1	0	0.25	1.75	0	0	0	0	0.00	0.00
July 28	1	0	2	0	0.75	2.50	0	0	0	0	0.00	0.00
July 30	0	0	0	0	0.00	2.50	0	0	0	0	0.00	0.00
Aug. 1	0	0	0	0	0.00	2.50	0	0	0	0	0.00	0.00
Aug. 3	0	0	0	0	0.00	2.50	0	0	0	0	0.00	0.00
Aug. 5	0	0	0	0	0.00	2.50	0	0	0	0	0.00	0.00
Total	5	1	3	1	2.50	2.50	0	0	0	0	0.00	0.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 2. Germination percentages for 0.5-months-old jointed goatgrass spikelets collected from Echo on July 5, 1983. Germination experiments started July 19, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 22	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 24	0	0	0	0	0.00	0.00	3	2	0	0	1.25	1.25
July 26	0	0	0	0	0.00	0.00	41	7	2	7	14.25	15.50
July 28	0	0	0	0	0.00	0.00	12	7	5	7	7.75	23.25
July 30	0	0	3	0	0.75	0.75	0	5	2	2	2.25	25.50
Aug. 1	0	5	22	9	9.00	9.75	2	1	1	0	1.00	26.50
Aug. 3	14	5	32	13	16.00	25.75	1	1	0	0	0.50	27.00
Aug. 5	8	6	9	5	7.00	32.75	2	1	0	0	0.75	27.75
Aug. 7	3	3	4	5	3.75	36.50	0	0	1	0	0.25	28.00
Aug. 9	1	0	2	0	0.75	37.25	0	0	0	0	0.00	28.00
Aug. 11	2	3	0	4	2.25	39.50	0	0	0	0	0.00	28.00
Aug. 13	1	2	0	4	1.75	41.25	0	1	0	1	0.50	28.50
Aug. 15	5	1	1	2	2.25	43.50	0	0	0	0	0.00	28.50
Total	34	25	73	42	43.50	43.50	61	25	11	17	28.50	28.50
(continued)												

Appendix Table 2. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
July 22	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 24	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 26	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 28	0	0	1	0	0.25	0.25	0	0	0	0	0.00	0.00
July 30	0	0	2	1	0.75	1.00	0	0	0	0	0.00	0.00
Aug. 1	0	0	0	0	0.00	1.00	0	0	0	0	0.00	0.00
Aug. 3	0	2	3	0	1.25	2.25	0	0	0	0	0.00	0.00
Aug. 5	1	1	4	0	1.50	3.75	0	0	0	0	0.00	0.00
Aug. 7	1	1	6	0	2.00	5.75	0	0	0	0	0.00	0.00
Aug. 9	0	0	2	0	0.50	6.25	0	0	0	0	0.00	0.00
Aug. 11	0	0	3	1	1.00	7.25	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	7.25	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	7.25	0	0	0	0	0.00	0.00
Total	2	4	21	2	7.25	7.25	0	0	0	0	0.00	0.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 3. Germination percentages for 1-month-old jointed goatgrass spikelets collected from Echo on July 5, 1983. Germination experiments started August 2, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	1	0	0	1	0.50	0.50
Aug. 13	0	0	0	0	0.00	0.00	0	4	3	4	2.75	3.25
Aug. 15	0	0	2	1	0.75	0.75	1	0	0	2	0.75	4.00
Aug. 17	2	5	18	8	8.25	9.00	1	0	6	1	2.00	6.00
Aug. 19	11	15	15	10	12.75	21.75	0	5	2	1	2.00	8.00
Aug. 21	3	4	7	4	4.50	26.25	1	2	4	0	1.75	9.75
Aug. 23	1	2	0	4	1.75	28.00	0	0	1	0	0.25	10.00
Aug. 25	2	0	0	1	0.75	28.75	1	2	1	0	1.00	11.00
Aug. 27	4	1	1	2	2.00	30.75	1	1	2	0	1.00	12.00
Aug. 29	3	0	3	6	3.00	33.75	0	4	0	0	1.00	13.00
Total	26	27	46	36	33.75	33.75	6	18	19	9	13.00	13.00

(continued)

Appendix Table 3. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 17	0	0	1	0	0.25	0.25	0	0	0	0	0.00	0.00
Aug. 19	0	0	0	0	0.00	0.25	0	0	0	0	0.00	0.00
Aug. 21	1	0	1	0	0.50	0.75	0	0	0	0	0.00	0.00
Aug. 23	0	0	1	1	0.50	1.25	0	0	0	0	0.00	0.00
Aug. 25	0	0	0	0	0.00	1.25	0	0	0	0	0.00	0.00
Aug. 27	0	2	0	0	0.50	1.75	0	0	0	0	0.00	0.00
Aug. 29	0	0	0	0	0.00	1.75	0	0	0	0	0.00	0.00
Total	1	2	3	1	1.75	1.75	0	0	0	0	0.00	0.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 4. Germination percentages for 2-months-old jointed goatgrass spikelets collected from Echo on July 5, 1983. Germination experiments started August 30, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Sept. 2	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 4	0	0	0	0	0.00	0.00	2	1	1	3	1.75	1.75
Sept. 6	0	0	0	0	0.00	0.00	18	20	12	12	15.50	17.25
Sept. 8	0	0	0	0	0.00	0.00	27	39	43	25	33.50	50.75
Sept. 10	0	0	0	0	0.00	0.00	24	11	17	21	18.25	69.00
Sept. 12	1	0	0	0	0.25	0.25	7	2	2	3	3.50	72.50
Sept. 14	7	4	6	3	5.00	5.25	1	2	3	2	2.00	74.50
Sept. 16	19	14	13	16	15.50	20.75	1	3	1	1	1.50	76.00
Sept. 18	21	17	24	18	20.00	40.75	0	1	1	1	0.75	76.75
Sept. 20	3	5	8	10	6.50	47.25	0	0	0	0	0.00	76.75
Sept. 22	1	11	5	0	4.25	51.50	0	0	0	1	0.25	77.00
Sept. 24	0	3	7	0	2.50	54.00	0	1	0	0	0.25	77.25
Sept. 26	3	2	3	4	3.00	57.00	0	2	0	1	0.75	78.00
Total	55	56	66	51	57.00	57.00	80	82	80	70	78.00	78.00

(continued)

Appendix Table 4. (continued)

Date	Temperature-----											
	23 C						29 C					
	(1983)				R1	R2	R3	R4	Mean			
Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean						
------(%)-----												
Sept. 2	0	0	0	0	0.00	0.00			0	0	0	0
Sept. 4	0	0	1	0	0.25	0.25			0	0	0	0
Sept. 6	23	22	15	40	25.00	25.25			0	0	0	0
Sept. 8	24	24	35	28	27.75	53.00			2	0	0	0
Sept. 10	28	17	11	10	16.50	69.50			4	0	2	0
Sept. 12	3	1	3	2	2.25	71.75			4	0	2	3
Sept. 14	2	1	3	4	2.50	74.25			3	1	5	8
Sept. 16	0	2	2	0	1.00	75.25			6	1	5	8
Sept. 18	0	0	0	0	0.00	75.25			1	0	2	2
Sept. 20	0	1	0	0	0.25	75.50			1	0	6	2
Sept. 22	0	0	0	0	0.00	75.50			3	0	2	2
Sept. 24	0	0	0	0	0.00	75.50			0	0	1	4
Sept. 26	0	1	0	0	0.25	75.75			3	0	0	2
Total	80	69	70	84	75.75	75.75			27	2	25	31
											21.25	21.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 5. Germination percentages for 3-months-old jointed goatgrass spikelets collected from Echo on July 5, 1983. Germination experiments started September 27, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
Sept. 30	0	0	0	0	0.00	0.00	0	2	3	0	1.25	1.25
Oct. 2	0	0	0	0	0.00	0.00	6	2	2	3	3.25	4.50
Oct. 4	0	0	0	0	0.00	0.00	12	16	7	5	10.00	14.50
Oct. 6	0	0	0	0	0.00	0.00	5	5	5	10	6.25	20.75
Oct. 8	0	0	0	0	0.00	0.00	5	4	1	9	4.75	25.50
Oct. 10	0	0	0	0	0.00	0.00	2	2	0	3	1.75	27.25
Oct. 12	2	8	2	6	4.50	4.50	3	1	0	1	1.25	28.50
Oct. 14	2	13	10	7	8.00	12.50	3	1	2	2	2.00	30.50
Oct. 16	9	16	4	2	7.75	20.25	2	1	1	2	1.50	32.00
Oct. 18	3	0	12	4	4.75	25.00	3	1	0	0	1.00	33.00
Oct. 20	6	3	1	2	3.00	28.00	3	1	0	2	1.50	34.50
Oct. 22	1	2	2	0	1.25	29.25	0	0	0	0	0.00	34.50
Oct. 24	5	2	0	5	3.00	32.25	1	0	0	1	0.50	35.00
Total	28	44	31	26	32.25	32.25	45	36	21	38	35.00	35.00

(continued)

Appendix Table 5. (continued)

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Sept. 30	2	0	0	2	1.00	1.00	0	1	0	0	0.25	0.25
Oct. 2	0	4	2	3	2.25	3.25	0	1	1	0	0.50	0.75
Oct. 4	11	10	7	2	7.50	10.75	0	0	1	2	0.75	1.50
Oct. 6	9	6	12	10	9.25	20.00	1	0	1	0	0.50	2.00
Oct. 8	4	5	3	7	4.75	24.75	0	2	0	1	0.75	2.75
Oct. 10	0	3	1	1	1.25	26.00	0	1	0	0	0.25	3.00
Oct. 12	0	1	4	2	1.75	27.75	0	0	0	0	0.00	3.00
Oct. 14	2	0	1	1	1.00	28.75	0	0	0	0	0.00	3.00
Oct. 16	2	0	2	2	1.50	30.25	0	0	1	0	0.25	3.25
Oct. 18	4	0	0	2	1.50	31.75	0	0	0	0	0.00	3.25
Oct. 20	2	0	0	1	0.75	32.50	1	0	0	0	0.25	3.50
Oct. 22	0	1	1	0	0.50	33.00	0	0	0	0	0.00	3.50
Oct. 24	0	0	0	0	0.00	33.00	0	0	0	0	0.00	3.50
Total	36	30	33	33	33.00	33.00	2	5	4	3	3.50	3.50

¹No germination at 38 C. Data not shown.

Appendix Table 6. Germination percentages for 4-months-old jointed goatgrass spikelets collected from Echo on July 5, 1983. Germination experiments started October 25, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 28	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 30	0	0	0	0	0.00	0.00	26	5	11	4	11.50	11.50
Nov. 1	0	0	0	0	0.00	0.00	22	12	17	25	19.00	30.50
Nov. 3	0	0	0	0	0.00	0.00	14	8	6	4	8.00	38.50
Nov. 5	0	0	0	0	0.00	0.00	2	5	2	0	2.25	40.75
Nov. 7	0	1	0	1	0.50	0.50	1	4	0	4	2.25	43.00
Nov. 9	7	3	3	2	3.75	4.25	1	0	1	2	1.00	44.00
Nov. 11	8	6	18	7	9.75	14.00	1	4	1	2	2.00	46.00
Nov. 13	11	13	18	11	13.25	27.25	2	2	1	0	1.25	47.25
Nov. 15	4	5	5	4	4.50	31.75	1	1	1	0	0.75	48.00
Nov. 17	3	6	5	3	4.25	36.00	4	3	1	2	2.50	50.50
Nov. 19	4	7	2	3	4.00	40.00	0	0	0	0	0.00	50.50
Nov. 21	3	1	4	0	2.00	42.00	0	0	0	0	0.00	50.50
Total	40	42	55	31	42.00	42.00	74	44	41	43	50.50	50.50

(continued)

Appendix Table 6. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 28	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 30	5	48	10	20	20.75	20.75	4	4	1	2	2.75	2.75
Nov. 1	6	20	19	22	16.75	37.50	1	8	7	22	9.50	12.25
Nov. 3	7	1	7	15	7.50	45.00	6	4	3	9	5.50	17.75
Nov. 5	5	4	2	5	4.00	49.00	1	1	2	3	1.75	19.50
Nov. 7	2	2	0	0	1.00	50.00	1	1	1	1	1.00	20.50
Nov. 9	1	2	3	3	2.25	52.25	0	0	2	3	1.25	21.75
Nov. 11	2	1	0	0	0.75	53.00	0	1	4	5	2.50	24.25
Nov. 13	1	0	1	3	1.25	54.25	0	3	2	0	1.25	25.50
Nov. 15	0	0	1	3	1.00	55.25	0	2	2	2	1.50	27.00
Nov. 17	2	0	1	0	0.75	56.00	0	1	1	1	0.75	27.75
Nov. 19	1	0	1	0	0.50	56.50	0	0	2	0	0.50	28.25
Nov. 21	0	0	1	1	0.50	57.00	0	0	0	1	0.25	28.50
Total	32	78	46	72	57.00	57.00	13	25	27	49	28.50	28.50

¹No germination occurred at 38 C. Data not shown.

Appendix Table 7. Germination percentages for 12-months-old jointed goatgrass spikelets collected from Echo on July 5, 1983. Germination experiments started August 8, 1984.¹

Date (1984)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	0	0	0	0	0.00	0.00	0	2	0	12	3.50	3.50
Aug. 13	0	0	0	0	0.00	0.00	2	2	2	6	3.00	6.50
Aug. 15	0	0	0	0	0.00	0.00	6	12	17	6	10.25	16.75
Aug. 17	0	0	0	0	0.00	0.00	11	4	9	8	8.00	24.75
Aug. 19	0	0	0	0	0.00	0.00	5	6	7	6	6.00	30.75
Aug. 21	1	0	0	0	0.25	0.25	0	3	3	3	2.25	33.00
Aug. 23	0	0	0	0	0.00	0.25	1	2	1	3	1.75	34.75
Aug. 25	2	3	1	0	1.50	1.75	0	1	0	0	0.25	35.00
Aug. 27	17	25	16	18	19.00	20.75	0	3	2	1	1.50	36.50
Aug. 29	12	12	12	3	9.75	30.50	1	1	0	0	0.50	37.00
Aug. 31	7	5	9	22	10.75	41.25	0	1	0	0	0.25	37.25
Sept. 2	8	8	10	8	8.50	49.75	1	1	0	0	0.50	37.75
Sept. 4	2	2	1	3	2.00	51.75	1	1	0	0	0.50	38.25
Total	49	55	49	54	51.75	51.75	28	39	41	45	38.25	38.25

(continued)

Appendix Table 7. (continued)

Date (1984)	Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	58	4	22	11	23.75	23.75	31	49	53	30	40.75	40.75
Aug. 13	11	3	11	15	10.00	33.75	3	12	25	16	14.00	54.75
Aug. 15	5	0	11	3	4.75	38.50	7	7	7	1	5.50	60.25
Aug. 17	1	1	0	8	2.50	41.00	3	0	1	1	1.25	61.50
Aug. 19	0	0	0	2	0.50	41.50	1	2	0	1	1.00	62.50
Aug. 21	0	0	1	0	0.25	41.75	1	2	0	1	1.00	63.50
Aug. 23	0	1	2	2	1.25	43.00	1	0	1	0	0.50	64.00
Aug. 25	0	0	0	0	0.00	43.00	0	1	2	0	0.75	64.75
Aug. 27	1	2	1	1	1.25	44.25	2	0	0	0	0.50	65.25
Aug. 29	0	0	0	0	0.00	44.25	0	0	0	0	0.00	65.25
Aug. 31	0	0	0	0	0.00	44.25	0	0	2	0	0.50	65.75
Sept. 2	0	0	0	0	0.00	44.25	0	0	0	0	0.00	65.75
Sept. 4	0	0	0	0	0.00	44.25	0	0	0	0	0.00	65.75
Total	76	11	48	42	44.25	44.25	49	73	91	50	65.75	65.75

¹No germination occurred at 38 C. Data not shown.

Appendix Table 8. Germination percentages for 0-months-old jointed goatgrass spikelets collected from Ione on July 7, 1983. Germination experiments started July 9, 1983.¹

Date (1983)	Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 12	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 14	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 16	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 18	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 20	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 22	0	0	0	0	0.00	0.00	0	4	1	0	1.25	1.25
July 24	0	0	1	0	0.25	0.25	0	3	2	1	1.50	2.75
July 26	2	1	2	2	1.75	2.00	1	0	4	3	2.00	4.75
July 28	6	4	1	1	3.00	5.00	0	0	2	1	0.75	5.50
July 30	5	2	2	4	3.25	8.25	2	0	2	1	1.25	6.75
Aug. 1	2	0	2	2	1.50	9.75	2	0	0	0	0.50	7.25
Aug. 3	2	2	0	2	1.50	11.25	0	0	2	1	0.75	8.00
Aug. 5	1	1	1	1	1.00	12.25	0	0	1	0	0.25	8.25
Total	18	10	9	12	12.25	12.25	5	7	14	7	8.25	8.25

(continued)

Appendix Table 8. (continued)

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 12	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 14	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 16	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 18	0	1	0	0	0.25	0.25	0	0	0	0	0.00	0.00
July 20	0	0	0	2	0.50	0.75	0	0	0	0	0.00	0.00
July 22	0	1	0	2	0.75	1.50	0	0	0	0	0.00	0.00
July 24	0	1	0	2	0.75	2.25	0	0	0	0	0.00	0.00
July 26	0	0	0	1	0.25	2.50	0	0	0	0	0.00	0.00
July 28	0	0	0	1	0.25	2.75	0	1	0	0	0.25	0.25
July 30	0	3	0	0	0.75	3.50	0	0	0	0	0.00	0.25
Aug. 1	0	0	0	0	0.00	3.50	0	0	0	0	0.00	0.25
Aug. 3	0	0	0	2	0.50	4.00	0	0	0	0	0.00	0.25
Aug. 5	0	0	0	3	0.75	4.75	0	0	0	0	0.00	0.25
Total	0	6	0	13	4.75	4.75	0	1	0	0	0.25	0.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 9. Germination percentages for 0.5-months-old jointed goatgrass spikelets collected from Ione on July 7, 1983. Germination experiments started July 21, 1983.¹

Date (1983)	Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 24	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 26	0	0	0	0	0.00	0.00	1	2	0	0	0.75	0.75
July 28	0	0	0	0	0.00	0.00	11	8	10	13	10.50	11.25
July 30	0	0	0	0	0.00	0.00	11	20	31	22	21.00	32.25
Aug. 1	0	0	0	0	0.00	0.00	5	7	3	2	4.25	36.50
Aug 3	31	12	12	12	16.75	16.75	2	9	8	3	5.50	42.00
Aug 5	26	16	22	14	19.50	36.25	2	3	2	1	2.00	44.00
Aug 7	8	16	11	12	11.75	48.00	2	0	0	2	1.00	45.00
Aug 9	1	6	2	1	2.50	50.50	1	4	1	1	1.75	46.75
Aug 11	0	1	3	2	1.50	52.00	0	0	1	1	0.50	47.25
Aug. 13	2	0	0	1	0.75	52.75	0	1	0	0	0.25	47.50
Aug. 15	1	0	1	1	0.75	53.50	0	1	1	0	0.50	48.00
Aug. 17	0	0	1	2	0.75	54.25	0	0	0	0	0.00	48.00
Total	69	51	52	45	54.25	54.25	35	55	57	45	48.00	48.00

(continued)

Appendix Table 9. (continued)

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 24	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 26	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 28	0	1	0	0	0.25	0.25	0	0	0	0	0.00	0.00
July 30	1	1	0	0	0.50	0.75	1	0	0	0	0.25	0.25
Aug. 1	0	2	0	2	1.00	1.75	0	0	0	0	0.00	0.25
Aug. 3	4	3	3	1	2.75	4.50	1	0	0	0	0.25	0.50
Aug. 5	2	1	0	5	2.00	6.50	0	0	0	0	0.00	0.50
Aug. 7	5	2	0	5	3.00	9.50	0	0	0	0	0.00	0.50
Aug. 9	1	3	0	1	1.25	10.75	1	0	0	3	1.00	1.50
Aug. 11	1	3	0	2	1.50	12.25	0	0	0	0	0.00	1.50
Aug. 13	2	2	0	2	1.50	13.75	0	0	0	0	0.00	1.50
Aug. 15	2	0	0	1	0.75	14.50	0	0	0	0	0.00	1.50
Aug. 17	1	2	0	5	2.00	16.50	0	0	0	0	0.00	1.50
Total	19	20	3	24	16.50	16.50	3	0	0	3	1.50	1.50

¹No germination occurred at 38 C. Data not shown.

Appendix Table 10. Germination percentages for 1-month-old jointed goatgrass spikelets collected from Ione on July 7, 1983. Germination experiments started August 4, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	1	0	0	0.25	0.25
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.25
Aug. 17	0	0	1	0	0.25	0.25	2	0	1	1	1.00	1.25
Aug. 19	5	4	1	1	2.75	3.00	0	0	0	2	0.50	1.75
Aug. 21	3	2	1	2	2.00	5.00	0	2	1	5	2.00	3.75
Aug. 23	13	0	5	1	4.75	9.75	0	0	2	4	1.50	5.25
Aug. 25	4	1	4	1	2.50	12.25	0	0	2	1	0.75	6.00
Aug. 27	2	2	2	2	2.00	14.25	0	0	0	3	0.75	6.75
Aug. 29	3	1	2	3	2.25	16.50	0	0	0	1	0.25	7.00
Aug. 31	3	0	0	0	0.75	17.25	0	1	0	1	0.50	7.50
Total	33	10	16	10	17.25	17.25	2	4	6	18	7.50	7.50

(continued)

Appendix Table 10. (continued)

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	1	0.25	0.25
Aug. 17	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.25
Aug. 19	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.25
Aug. 21	2	0	0	0	0.50	0.50	0	1	0	0	0.25	0.50
Aug. 23	0	0	1	1	0.50	1.00	0	0	1	0	0.25	0.75
Aug. 25	1	1	0	0	0.50	1.50	0	1	0	0	0.25	1.00
Aug. 27	1	1	1	3	1.50	3.00	0	0	0	0	0.00	1.00
Aug. 29	0	1	1	0	0.50	3.50	0	1	0	0	0.25	1.25
Aug. 31	0	0	0	0	0.00	3.50	0	0	0	0	0.25	1.25
Total	4	3	3	4	3.50	3.50	0	3	1	1	1.25	1.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 11. Germination percentages for 2-months-old jointed goatgrass spikelets collected from Ione on July 7, 1983. Germination experiments started September 1, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Sept. 4	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 6	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 8	0	0	0	0	0.00	0.00	0	9	5	2	4.00	4.00
Sept. 10	0	0	0	0	0.00	0.00	23	53	8	4	22.00	26.00
Sept. 12	0	0	0	0	0.00	0.00	15	10	3	1	7.25	33.25
Sept. 14	0	0	0	0	0.00	0.00	9	5	6	4	6.00	39.25
Sept. 16	0	1	0	2	0.75	0.75	6	3	3	2	3.50	42.75
Sept. 18	3	6	5	10	6.00	6.75	8	1	0	1	2.50	45.25
Sept. 20	13	13	12	10	12.00	18.75	0	1	0	3	1.00	46.25
Sept. 22	5	4	10	12	7.75	26.50	1	0	2	1	1.00	47.25
Sept. 24	6	5	5	9	6.25	32.75	1	0	0	0	0.25	47.50
Sept. 26	0	2	3	4	2.25	35.00	2	2	1	0	1.25	48.75
Sept. 28	0	1	0	2	0.75	35.75	0	0	0	0	0.00	48.75
Total	27	32	35	49	35.75	35.75	65	84	28	18	48.75	48.75

(continued)

Appendix Table 11. (continued)

Date (1983)	Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Sept. 4	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 6	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 8	5	1	1	2	2.25	2.25	0	0	0	0	0.00	0.00
Sept. 10	41	41	28	7	29.25	31.50	0	0	0	0	0.00	0.00
Sept. 12	12	15	25	7	14.75	46.25	4	1	1	3	2.25	2.25
Sept. 14	8	4	8	2	5.50	51.75	2	2	1	0	1.25	3.50
Sept. 16	1	1	3	3	2.00	53.75	2	1	0	0	0.75	4.25
Sept. 18	1	1	0	1	0.75	54.50	1	2	0	0	0.75	5.00
Sept. 20	1	0	0	0	0.25	54.75	5	0	0	1	1.50	6.50
Sept. 22	1	0	0	0	0.25	55.00	3	3	1	2	2.25	8.75
Sept. 24	1	1	0	0	0.50	55.50	5	1	0	1	1.75	10.50
Sept. 26	0	0	0	1	0.25	55.75	1	0	0	0	0.25	10.75
Sept. 28	0	0	0	0	0.00	55.75	2	1	0	2	1.25	12.00
Total	71	64	65	23	55.75	55.75	25	11	3	9	12.00	12.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 12. Germination percentages for 3-months-old jointed goatgrass spikelets collected from Ione on July 7, 1983. Germination experiments started October 2, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 7	0	0	0	0	0.00	0.00	2	0	0	1	0.75	0.75
Oct. 9	0	0	0	0	0.00	0.00	15	6	31	25	19.25	20.00
Oct. 11	0	0	0	0	0.00	0.00	9	7	20	10	11.50	31.50
Oct. 13	0	0	0	0	0.00	0.00	5	7	9	6	6.75	38.25
Oct. 15	0	0	0	0	0.00	0.00	4	9	3	1	4.25	42.50
Oct. 17	0	0	0	0	0.00	0.00	0	5	0	0	1.25	43.75
Oct. 19	2	3	0	1	1.50	1.50	3	1	1	0	1.25	45.00
Oct. 21	21	7	9	4	10.25	11.75	3	0	0	0	0.75	45.75
Oct. 23	3	8	5	3	4.75	16.50	1	0	1	0	0.50	46.25
Oct. 25	6	3	2	3	3.50	20.00	0	0	0	0	0.00	46.25
Oct. 27	5	1	1	2	2.25	22.25	0	2	0	1	0.75	47.00
Oct. 29	0	3	0	1	1.00	23.25	1	1	0	0	0.50	47.50
Total	37	25	17	14	23.25	23.25	43	38	65	44	47.50	47.50

(continued)

Appendix Table 12. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 2	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 4	5	4	18	16	10.75	10.75	2	5	1	2	2.50	2.50
Oct. 6	13	18	21	22	18.50	29.25	5	16	14	8	10.75	13.25
Oct. 8	16	23	24	17	20.00	49.25	7	7	6	6	6.50	19.75
Oct. 10	5	8	3	1	4.25	53.50	2	2	1	1	1.50	21.25
Oct. 12	7	2	3	1	3.25	56.75	2	2	0	1	1.25	22.50
Oct. 14	1	3	0	4	2.00	58.75	1	0	0	1	0.50	23.00
Oct. 16	3	2	1	3	2.25	61.00	0	3	0	2	1.25	24.25
Oct. 18	1	0	1	2	1.00	62.00	0	0	1	0	0.25	24.50
Oct. 20	0	1	1	0	0.50	62.50	0	0	0	0	0.00	24.50
Oct. 22	0	0	0	0	0.00	62.50	0	0	0	0	0.00	24.50
Oct. 24	0	1	0	0	0.25	62.75	0	0	0	0	0.00	24.50
Oct. 26	0	0	0	0	0.00	62.75	1	0	0	0	0.25	24.75
Total	51	62	72	66	62.75	62.75	20	35	23	21	24.75	24.75

¹No germination occurred at 38 C. Data not shown.

Appendix Table 13. Germination percentages for 4-months-old jointed goatgrass spikelets collected from Ione on July 7, 1983. Germination experiments started October 27, 1983.¹

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov. 1	0	0	0	0	0.00	0.00	6	2	1	7	4.00	4.00
Nov. 3	0	0	0	0	0.00	0.00	15	13	6	15	12.25	16.25
Nov. 5	0	0	0	0	0.00	0.00	13	9	9	9	10.00	26.25
Nov. 7	0	0	0	0	0.00	0.00	2	3	2	2	2.25	28.50
Nov. 9	0	0	0	0	0.00	0.00	1	0	1	3	1.25	29.75
Nov. 11	0	0	1	0	0.25	0.25	1	2	1	1	1.25	31.00
Nov. 13	1	2	8	1	3.00	3.25	2	2	0	3	1.75	32.75
Nov. 15	4	2	6	9	5.25	8.50	0	1	1	0	0.50	33.25
Nov. 17	3	1	4	0	2.00	10.50	0	4	0	0	1.00	34.25
Nov. 19	2	1	1	0	1.00	11.50	2	1	0	0	0.75	35.00
Nov. 21	0	0	1	4	1.25	12.75	0	0	0	1	0.25	35.25
Nov. 23	2	1	1	1	1.25	14.00	0	0	0	0	0.00	35.25
Total	12	7	22	15	14.00	14.00	42	37	21	41	35.25	35.25

(continued)

Appendix Table 13. (continued)

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov. 1	4	10	8	1	5.75	5.75	1	0	1	1	0.75	0.75
Nov. 3	12	17	9	12	12.50	18.25	6	5	5	4	5.00	5.75
Nov. 5	9	6	11	11	9.25	27.50	1	1	2	1	1.25	7.00
Nov. 7	4	4	3	0	2.75	30.25	5	0	2	1	2.00	9.00
Nov. 9	1	3	3	4	2.75	33.00	2	1	1	1	1.25	10.25
Nov. 11	2	4	3	0	2.25	35.25	5	3	3	1	3.00	13.25
Nov. 13	2	2	1	1	1.50	36.75	3	0	0	0	0.75	14.00
Nov. 15	1	0	1	0	0.50	37.25	0	0	0	0	0.00	14.00
Nov. 17	0	0	0	0	0.00	37.25	0	1	0	1	0.50	14.50
Nov. 19	0	0	1	1	0.50	37.75	0	0	0	0	0.00	14.50
Nov. 21	0	1	0	1	0.50	38.25	1	0	0	0	0.25	14.75
Nov. 23	0	0	0	0	0.00	38.25	0	1	0	0	0.25	15.00
Total	35	47	40	31	38.25	38.25	24	12	14	10	15.00	15.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 14. Germination percentages for 12-months-old jointed goatgrass spikelets collected from Ione on July 7, 1983. Germination experiments started August 8, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	0	0	0	0	0.00	0.00	5	12	52	7	19.00	19.00
Aug. 13	0	0	0	0	0.00	0.00	6	11	10	19	11.50	30.50
Aug. 15	0	0	0	0	0.00	0.00	8	13	7	7	8.75	39.25
Aug. 17	0	0	0	0	0.00	0.00	4	2	3	2	2.75	42.00
Aug. 19	0	0	5	2	1.75	1.75	3	2	0	4	2.25	44.25
Aug. 21	0	0	2	2	1.00	2.75	2	1	0	0	0.75	45.00
Aug. 23	0	0	0	0	0.00	2.75	1	2	0	6	2.25	47.25
Aug. 25	1	1	4	7	3.25	6.00	2	0	0	2	1.00	48.25
Aug. 27	5	2	10	12	7.25	13.25	0	0	0	2	0.50	48.75
Aug. 29	1	2	1	4	2.00	15.25	1	1	1	1	1.00	49.75
Aug. 31	1	2	8	1	3.00	18.25	1	3	0	1	1.25	51.00
Sept. 2	0	1	6	7	3.50	21.75	2	0	0	0	0.50	51.50
Sept. 4	4	6	5	8	5.75	27.50	1	0	1	0	0.50	52.00
Total	12	14	41	43	27.50	27.50	36	47	74	51	52.00	52.00

(continued)

Appendix Table 14. (continued)

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	56	39	61	50	51.50	51.50	47	70	53	41	52.75	52.75
Aug. 13	6	6	10	12	8.50	60.00	10	8	11	10	9.75	62.50
Aug. 15	2	2	0	4	2.00	62.00	2	0	4	3	2.25	64.75
Aug. 17	1	1	2	2	1.50	63.50	1	0	0	1	0.50	65.25
Aug. 19	0	1	0	0	0.25	63.75	0	0	1	0	0.25	65.50
Aug. 21	0	0	0	0	0.00	63.75	0	0	5	1	1.50	67.00
Aug. 23	0	0	1	0	0.25	64.00	0	0	2	1	0.75	67.75
Aug. 25	0	0	0	0	0.00	64.00	1	0	1	0	0.50	68.25
Aug. 27	0	0	0	0	0.00	64.00	0	0	0	0	0.00	68.25
Aug. 29	0	0	0	0	0.00	64.00	0	0	0	0	0.00	68.25
Aug. 31	0	0	0	0	0.00	64.00	0	0	0	0	0.00	68.25
Sept. 2	0	0	0	0	0.00	64.00	0	0	0	0	0.00	68.25
Sept. 4	0	0	0	0	0.00	64.00	0	0	0	0	0.00	68.25
Total	65	49	74	68	64.00	64.00	61	78	77	57	68.25	68.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 15. Germination percentages for 0-months-old jointed goatgrass spikelets collected from Pendleton on July 13, 1983. Germination experiments started July 13, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 16	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 18	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 20	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 22	0	0	0	0	0.00	0.00	0	1	1	0	0.50	0.50
July 24	0	0	0	0	0.00	0.00	2	0	5	0	1.75	2.25
July 26	1	1	2	1	1.25	1.25	1	2	3	3	2.25	4.50
July 28	0	0	0	2	0.50	1.75	1	1	4	0	1.50	6.00
July 30	3	4	6	5	4.50	6.25	1	0	2	1	1.00	7.00
Aug. 1	3	1	0	0	1.00	7.25	1	1	2	0	1.00	8.00
Aug. 3	1	1	6	4	3.00	10.25	0	1	0	1	0.50	8.50
Aug. 5	0	3	3	4	2.50	12.75	0	0	0	0	0.00	8.50
Aug. 7	2	2	0	2	1.50	14.25	0	0	0	0	0.00	8.50
Aug. 9	0	1	0	3	1.00	15.25	0	0	0	0	0.00	8.50
Total	10	13	17	21	15.25	15.25	6	6	17	5	8.50	8.50

(continued)

Appendix Table 15. (continued)

Date (1983)	Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 16	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 18	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 20	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 22	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 24	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 26	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 28	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 1	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 3	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	1	0	0.25	0.25
Total	0	0	0	0	0.00	0.00	0	0	1	0	0.25	0.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 16. Germination percentages for 0.5-months-old jointed goatgrass spikelets collected from Pendleton on July 13, 1983. Germination experiments started July 27, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 1	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 3	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 5	0	0	0	0	0.00	0.00	1	0	0	0	0.25	0.25
Aug. 7	0	0	0	0	0.00	0.00	1	0	0	0	0.25	0.50
Aug. 9	0	1	1	0	0.50	0.50	3	0	0	0	0.75	1.25
Aug. 11	8	2	7	1	4.50	5.00	5	2	0	2	2.25	3.50
Aug. 13	4	4	15	7	7.50	12.50	0	1	0	1	0.50	4.00
Aug. 15	3	2	3	0	2.00	14.50	4	1	0	0	1.25	5.25
Aug. 17	3	3	1	2	2.25	16.75	2	1	0	0	0.75	6.00
Aug. 19	3	1	0	0	1.00	17.75	1	2	0	1	1.00	7.00
Aug. 21	0	2	3	1	1.50	19.25	1	2	0	5	2.00	9.00
Aug. 23	0	0	0	0	0.00	19.25	0	0	0	1	0.25	9.25
Total	21	15	30	11	19.25	19.25	18	9	0	10	9.25	9.25

(continued)

Appendix Table 16. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 1	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 3	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	0	1	0	0.25	0.25
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.25
Aug. 17	0	0	0	2	0.50	0.50	0	0	0	0	0.00	0.25
Aug. 19	0	0	0	0	0.00	0.50	0	0	0	0	0.00	0.25
Aug. 21	0	0	0	2	0.50	1.00	0	0	0	0	0.00	0.25
Aug. 23	0	0	0	1	0.25	1.25	0	0	0	0	0.00	0.25
Total	0	0	0	5	1.25	1.25	0	0	0	0	0.25	0.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 17. Germination percentages for 1-month-old jointed goatgrass spikelets collected from Pendleton on July 13, 1983. Germination experiments started August 10, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	0.00	1	7	0	0	2.00	2.00
Aug. 17	0	0	0	0	0.00	0.00	8	28	36	11	20.75	22.75
Aug. 19	0	0	0	0	0.00	0.00	7	11	21	11	12.50	35.25
Aug. 21	0	0	0	0	0.00	0.00	10	9	10	12	10.25	45.50
Aug. 23	0	2	1	1	1.00	1.00	8	2	3	8	5.25	50.75
Aug. 25	0	2	1	10	3.25	4.25	2	3	3	1	2.25	53.00
Aug. 27	6	11	4	8	7.25	11.50	0	2	0	3	1.25	54.25
Aug. 29	1	2	7	2	3.00	14.50	0	0	0	0	0.00	54.25
Aug. 31	4	7	3	2	4.00	18.50	0	2	0	1	0.75	55.00
Sept. 2	0	0	1	1	0.50	19.00	0	0	0	0	0.00	55.00
Sept. 4	0	3	1	3	1.75	20.75	0	1	0	1	0.50	55.50
Sept. 6	2	0	1	0	0.75	21.50	0	0	1	0	0.25	55.75
Total	13	27	19	27	21.50	21.50	36	65	74	48	55.75	55.75

(continued)

Appendix Table 17. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 17	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 19	0	0	0	0	0.00	0.00	1	0	0	0	0.25	0.25
Aug. 21	1	1	0	1	0.75	0.75	0	0	0	0	0.00	0.25
Aug. 23	3	0	0	3	1.50	2.25	0	0	0	0	0.00	0.25
Aug. 25	2	0	0	9	2.75	5.00	1	1	0	0	0.50	0.75
Aug. 27	4	7	3	7	5.25	10.25	0	1	0	0	0.25	1.00
Aug. 29	4	3	3	10	5.00	15.25	0	0	0	0	0.00	1.00
Aug. 31	6	2	3	6	4.25	19.50	0	0	0	0	0.00	1.00
Sept. 2	3	1	1	1	1.50	21.00	0	1	1	0	0.50	1.50
Sept. 4	9	2	7	2	5.00	26.00	1	4	0	0	1.25	2.75
Sept. 6	4	0	1	6	2.75	28.75	0	1	0	1	0.50	3.25
Total	36	16	18	45	28.75	28.75	3	8	1	1	3.25	3.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 18. Germination percentages for 2-months-old jointed goatgrass spikelets collected from Pendleton on July 13, 1983. Germination experiments started September 7, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
------(%)-----												
Sept. 10	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 12	0	0	0	0	0.00	0.00	1	1	2	2	1.50	1.50
Sept. 14	0	0	0	0	0.00	0.00	6	44	39	75	41.00	42.50
Sept. 16	0	0	0	0	0.00	0.00	4	8	6	2	5.00	47.50
Sept. 18	0	0	0	0	0.00	0.00	2	8	4	2	4.00	51.50
Sept. 20	0	0	0	0	0.00	0.00	0	0	2	1	0.75	52.25
Sept. 22	1	0	0	0	0.25	0.25	0	2	1	0	0.75	53.00
Sept. 24	23	8	19	2	13.00	13.25	2	2	0	1	1.25	54.25
Sept. 26	18	15	11	10	13.50	26.75	1	0	0	0	0.25	54.50
Sept. 28	2	5	4	5	4.00	30.75	0	0	2	0	0.50	55.00
Sept. 30	0	0	0	0	0.00	30.75	0	0	4	1	1.25	56.25
Oct. 2	1	3	4	4	3.00	33.75	0	0	0	0	0.00	56.25
Oct. 4	0	1	1	2	1.00	34.75	0	0	0	1	0.25	56.50
Total	45	32	39	23	34.75	34.75	16	65	60	85	56.50	56.50

(continued)

Appendix Table 18. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
Sept. 10	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 12	2	3	1	0	1.50	1.50	0	0	0	0	0.00	0.00
Sept. 14	35	40	10	50	33.75	35.25	0	0	0	0	0.00	0.00
Sept. 16	11	6	11	8	9.00	44.25	0	2	0	0	0.50	0.50
Sept. 18	1	1	4	0	1.50	45.75	0	1	0	2	0.75	1.25
Sept. 20	1	0	2	1	1.00	46.75	1	3	1	3	2.00	3.25
Sept. 22	1	1	2	0	1.00	47.75	2	3	5	2	3.00	6.25
Sept. 24	0	0	2	0	0.50	48.25	4	4	1	3	3.00	9.25
Sept. 26	0	0	0	0	0.00	48.25	0	1	1	2	1.00	10.25
Sept. 28	0	0	0	1	0.25	48.50	0	2	6	2	2.50	12.75
Sept. 30	0	1	0	0	0.25	48.75	0	0	1	1	0.50	13.25
Oct. 2	0	0	0	0	0.00	48.75	1	0	0	3	1.00	14.25
Oct. 4	0	0	0	0	0.00	48.75	0	0	1	0	0.25	14.50
Total	51	52	32	60	48.75	48.75	8	16	16	18	14.50	14.50

¹No germination occurred at 38 C. Data not shown.

Appendix Table 19. Germination percentages for 3-months-old jointed goatgrass spikelets collected from Pendleton on July 13, 1983. Germination experiments started October 5, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 8	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 10	0	0	0	0	0.00	0.00	13	6	40	16	18.75	18.75
Oct. 12	0	0	0	0	0.00	0.00	19	13	21	30	20.75	39.50
Oct. 14	0	0	0	0	0.00	0.00	2	6	3	4	3.75	43.25
Oct. 16	0	0	0	0	0.00	0.00	2	5	0	5	3.00	46.25
Oct. 18	0	0	0	0	0.00	0.00	1	1	1	1	1.00	47.25
Oct. 20	1	3	8	1	3.25	3.25	1	0	6	1	2.00	49.25
Oct. 22	5	14	9	7	8.75	12.00	0	0	0	1	0.25	49.50
Oct. 24	12	9	5	11	9.25	21.25	0	1	1	0	0.50	50.00
Oct. 26	7	9	6	0	5.50	26.75	0	0	0	0	0.00	50.00
Oct. 28	5	1	5	5	4.00	30.75	1	0	0	1	0.50	50.50
Oct. 30	2	4	0	0	1.50	32.25	0	0	0	0	0.00	50.50
Nov. 1	2	3	3	1	2.25	34.50	0	0	1	0	0.25	50.75
Total	34	43	36	25	34.50	34.50	39	32	73	59	50.75	50.75

(continued)

Appendix Table 19. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
Oct. 8	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 10	7	38	20	14	19.75	19.75	3	0	4	0	1.75	1.75
Oct. 12	16	31	32	18	24.25	44.00	18	6	9	0	8.25	10.00
Oct. 14	8	4	2	3	4.25	48.25	10	11	4	2	6.75	16.75
Oct. 16	5	6	1	1	3.25	51.50	0	9	4	2	3.75	20.50
Oct. 18	0	0	2	0	0.50	52.00	1	1	5	0	1.75	22.25
Oct. 20	0	0	0	2	0.50	52.50	0	3	1	0	1.00	23.25
Oct. 22	0	0	0	0	0.00	52.50	0	1	1	0	0.50	23.75
Oct. 24	0	0	0	0	0.00	52.50	0	0	0	0	0.00	23.75
Oct. 26	1	0	0	1	0.50	53.00	0	0	0	0	0.00	23.75
Oct. 28	0	0	0	0	0.00	53.00	0	0	0	0	0.00	23.75
Oct. 30	0	0	0	0	0.00	53.00	0	0	0	0	0.00	23.75
Nov. 1	0	0	0	0	0.00	53.00	0	1	0	0	0.25	24.00
Total	37	79	57	39	53.00	53.00	32	32	28	4	24.00	24.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 20. Germination percentage for 4-months-old jointed goatgrass spikelets collected from Pendleton on July 13, 1983. Germination experiments started November 2, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
Nov. 5	0	0	0	0	0.00	0.00	1	0	0	0	0.25	0.25
Nov. 7	0	0	0	0	0.00	0.00	16	19	17	20	18.00	18.25
Nov. 9	0	0	0	0	0.00	0.00	10	10	8	14	10.50	28.75
Nov. 11	0	0	0	0	0.00	0.00	4	2	5	7	4.50	33.25
Nov. 13	0	0	0	0	0.00	0.00	2	4	5	1	3.00	36.25
Nov. 15	3	0	0	0	0.75	0.75	1	1	1	3	1.50	37.75
Nov. 17	12	7	8	2	7.25	8.00	1	2	0	0	0.75	38.50
Nov. 19	17	9	15	16	14.25	22.25	0	1	0	0	0.25	38.75
Nov. 21	2	8	5	7	5.50	27.75	0	0	0	0	0.00	38.75
Nov. 23	0	0	5	3	2.00	29.75	0	0	0	0	0.00	38.75
Nov. 25	6	4	1	3	3.50	33.25	0	0	0	0	0.00	38.75
Nov. 27	0	3	1	2	1.50	34.75	0	0	0	0	0.00	38.75
Nov. 29	0	3	0	3	1.50	36.25	0	0	0	0	0.00	38.75
Total	40	34	35	36	36.25	36.25	35	39	36	45	38.75	38.75

(continued)

Appendix Table 20. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Nov. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov. 7	28	36	33	49	36.50	36.50	1	5	3	1	2.50	2.50
Nov. 9	10	13	17	17	14.25	50.75	21	16	15	24	19.00	21.50
Nov. 11	4	1	2	2	2.25	53.00	10	9	20	18	14.25	33.75
Nov. 13	1	2	0	2	1.25	54.25	5	5	4	9	5.75	41.50
Nov. 15	0	0	0	0	0.00	54.25	3	0	2	0	1.25	42.75
Nov. 17	0	0	1	0	0.25	54.50	4	3	1	1	2.25	45.00
Nov. 19	1	0	0	0	0.25	54.75	1	1	0	0	0.50	45.50
Nov. 21	0	0	0	0	0.00	54.75	1	0	2	1	1.00	46.50
Nov. 23	0	0	0	0	0.00	54.75	1	0	0	1	0.50	47.00
Nov. 25	0	0	0	0	0.00	54.75	0	0	1	0	0.25	47.25
Nov. 27	0	0	0	0	0.00	54.75	0	0	0	0	0.00	47.25
Nov. 29	0	0	0	0	0.00	54.75	0	0	1	1	0.50	47.75
Total	44	52	53	70	54.75	54.75	47	39	49	56	47.75	47.75

¹No germination occurred at 38 C. Data not shown.

Appendix Table 21. Germination percentages for 12-months-old jointed goatgrass spikelets collected from Pendleton on July 13, 1983. Germination experiments started August 8, 1984.¹

Date (1984)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	0	0	0	0	0.00	0.00	3	20	31	9	15.75	15.75
Aug. 13	0	0	0	0	0.00	0.00	3	7	7	11	7.00	22.75
Aug. 15	0	0	0	0	0.00	0.00	4	8	5	9	6.50	29.25
Aug. 17	0	0	0	0	0.00	0.00	0	0	0	0	0.00	29.25
Aug. 19	0	0	0	0	0.00	0.00	1	2	3	1	1.75	31.00
Aug. 21	0	0	0	1	0.25	0.25	2	2	1	1	1.50	32.50
Aug. 23	0	2	0	1	0.75	1.00	1	0	0	3	1.00	33.50
Aug. 25	8	6	5	4	5.75	6.75	0	0	0	0	0.00	33.50
Aug. 27	9	6	6	8	7.25	14.00	0	0	0	0	0.00	33.50
Aug. 29	5	8	1	6	5.00	19.00	0	0	0	0	0.00	33.50
Aug. 31	4	5	5	4	4.50	23.50	0	0	1	0	0.25	33.75
Sept. 2	3	3	2	5	3.25	26.75	0	0	0	0	0.00	33.75
Sept. 4	4	2	6	2	3.50	30.25	0	0	0	0	0.00	33.75
Total	33	32	25	31	30.25	30.25	14	39	48	34	33.75	33.75

(continued)

Appendix Table 21. (continued)

Date (1984)	Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	62	52	15	25	38.50	38.50	51	34	72	39	49.00	49.00
Aug. 13	9	1	6	10	6.50	45.00	8	7	6	3	6.00	55.0
Aug. 15	2	4	4	1	2.75	47.75	6	7	1	16	7.50	62.50
Aug. 17	0	1	4	2	1.75	49.50	3	1	0	5	2.25	64.75
Aug. 19	0	0	1	0	0.25	49.75	1	3	0	0	1.00	65.75
Aug. 21	0	0	0	0	0.00	49.75	2	0	0	2	1.00	66.75
Aug. 23	0	0	0	0	0.00	49.75	1	0	0	1	0.50	67.25
Aug. 25	0	0	0	0	0.00	49.75	0	0	0	0	0.00	67.25
Aug. 27	0	0	0	0	0.00	49.75	0	0	0	0	0.00	67.25
Aug. 29	0	0	0	0	0.00	49.75	1	0	0	0	0.25	67.50
Aug. 31	1	0	0	0	0.25	50.00	0	0	0	0	0.00	67.50
Sept. 2	0	0	0	0	0.00	50.00	0	0	0	0	0.00	67.50
Sept. 4	0	0	0	0	0.00	50.00	0	0	0	0	0.00	67.50
Total	74	58	30	38	50.00	50.00	73	52	79	66	67.50	67.50

¹No germination occurred at 38 C. Data not shown.

Appendix Table 22. Germination percentages for 0-months-old jointed goatgrass spikelets collected from Condon on July 19, 1983. Germination experiments started July 19, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 22	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 24	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 26	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 28	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug 1	0	1	0	1	0.50	0.50	0	0	0	0	0.00	0.00
Aug 3	1	1	1	0	0.75	1.25	0	0	0	0	0.00	0.00
Aug 5	0	1	2	0	0.75	2.00	0	0	0	0	0.00	0.00
Aug 7	2	0	0	0	0.50	2.50	0	0	0	0	0.00	0.00
Aug 9	1	1	3	0	1.25	3.75	0	0	0	0	0.00	0.00
Aug. 11	1	1	0	0	0.50	4.25	0	0	0	0	0.00	0.00
Aug. 13	2	0	0	1	0.75	5.00	0	0	0	0	0.00	0.00
Aug. 15	1	0	2	2	1.25	6.25	0	0	0	0	0.00	0.00
Total	8	5	8	4	6.25	6.25	0	0	0	0	0.00	0.00

(continued)

Appendix Table 22. (continued)

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
July 22	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 24	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 26	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 28	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
July 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug 1	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug 3	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	1	0	0	0	0.25	0.25	0	0	0	0	0.00	0.00
Total	1	0	0	0	0.25	0.25	0	0	0	0	0.00	0.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 23. Germination percentages for 0.5-months-old jointed goatgrass spikelets collected from Condon on July 19, 1983. Germination experiments started August 2, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 17	3	0	1	1	1.25	1.25	0	0	0	0	0.00	0.00
Aug. 19	2	0	4	1	1.75	3.00	0	0	0	0	0.00	0.00
Aug. 21	3	1	2	3	2.25	5.25	2	2	0	0	1.00	1.00
Aug. 23	3	1	2	2	2.00	7.25	2	2	0	0	1.00	2.00
Aug. 25	2	0	1	0	0.75	8.00	1	1	1	0	0.75	2.75
Aug. 27	3	0	0	1	1.00	9.00	1	0	1	1	0.75	3.50
Aug. 29	4	0	1	2	1.75	10.75	0	1	0	0	0.25	3.75
Total	20	2	11	10	10.75	10.75	6	6	2	1	3.75	3.75

(continued)

Appendix Table 23. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 17	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 19	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 21	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 23	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 25	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 27	0	0	0	0	0.25	0.25	0	0	0	0	0.00	0.00
Aug. 29	0	0	0	0	0.00	0.25	0	0	0	0	0.00	0.00
Total	0	0	0	1	0.00	0.25	0	0	0	0	0.00	0.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 24. Germination percentages for 1-month-old jointed goatgrass spikelets collected from Condon on July 19, 1983. Germination experiments started August 16, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 19	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 21	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 23	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 25	0	0	0	0	0.00	0.00	2	23	0	0	6.25	6.25
Aug. 27	0	0	0	0	0.00	0.00	36	24	0	0	15.00	21.25
Aug. 29	0	0	0	0	0.00	0.00	12	12	1	3	7.00	28.25
Aug. 31	1	2	0	2	1.25	1.25	15	14	3	2	8.50	36.75
Sept. 2	21	14	2	3	10.00	11.25	4	8	3	2	4.25	41.00
Sept. 4	11	11	13	16	12.75	24.00	7	3	8	2	5.00	46.00
Sept. 6	8	4	2	11	6.25	30.25	2	2	5	6	3.75	49.75
Sept. 8	6	2	6	8	5.50	35.75	4	0	8	5	4.25	54.00
Sept. 10	2	0	0	2	1.00	36.75	1	1	1	6	2.25	56.25
Sept. 12	5	1	1	2	2.25	39.00	1	0	2	0	0.75	57.00
Total	54	34	24	44	39.00	39.00	84	87	31	26	57.00	57.00

(continued)

Appendix Table 24. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 19	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 21	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 23	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 25	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 27	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 29	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 31	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 2	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 4	0	0	0	1	0.25	0.25	0	0	0	0	0.00	0.00
Sept. 6	0	0	1	0	0.25	0.50	0	0	0	0	0.00	0.00
Sept. 8	0	0	0	1	0.25	0.75	0	0	0	0	0.00	0.00
Sept. 10	1	1	0	2	1.00	1.75	0	0	0	0	0.00	0.00
Sept. 12	0	1	3	3	1.75	3.50	0	0	0	0	0.00	0.00
Total	1	2	4	7	3.50	3.50	0	0	0	0	0.00	0.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 25. Germination percentages for 2-months-old jointed goatgrass spikelets collected from Condon on July 19, 1983. Germination experiments started September 13, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
------(%)-----												
Sept. 16	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 18	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 20	0	0	0	0	0.00	0.00	0	0	21	3	6.00	6.00
Sept. 22	0	0	0	0	0.00	0.00	10	17	9	10	11.50	17.50
Sept. 24	0	0	0	0	0.00	0.00	14	14	11	2	10.25	27.75
Sept. 26	0	0	0	0	0.00	0.00	4	2	2	6	3.50	31.25
Sept. 28	1	0	3	4	2.00	2.00	3	2	2	2	2.25	33.50
Sept. 30	3	0	4	3	2.50	4.50	1	0	1	8	2.50	36.00
Oct. 2	10	6	10	13	9.75	14.25	0	0	0	0	0.00	36.00
Oct. 4	4	4	2	5	3.75	18.00	0	0	0	0	0.00	36.00
Oct. 6	4	2	4	4	3.50	21.50	0	0	0	0	0.00	36.00
Oct. 8	5	4	5	2	4.00	25.50	0	0	0	1	0.25	36.25
Oct. 10	2	2	1	1	1.50	27.00	0	0	0	0	0.00	36.25
Total	29	18	29	32	27.00	27.00	32	35	46	32	36.25	36.25

(continued)

Appendix Table 25. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Sept. 16	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 18	0	0	1	0	0.25	0.25	0	0	0	0	0.00	0.00
Sept. 20	11	34	32	6	20.75	21.00	0	0	0	0	0.00	0.00
Sept. 22	8	17	11	6	10.50	31.50	0	0	0	0	0.00	0.00
Sept. 24	3	5	6	4	4.50	36.00	0	0	0	0	0.00	0.00
Sept. 26	2	2	4	3	2.75	38.75	0	0	0	0	0.00	0.00
Sept. 28	0	0	2	2	1.00	39.75	1	0	0	0	0.25	0.25
Sept. 30	0	0	0	0	0.00	39.75	0	5	1	0	1.50	1.75
Oct. 2	0	0	0	0	0.00	39.75	0	1	0	0	0.25	2.00
Oct. 4	0	1	0	0	0.25	40.00	0	0	0	0	0.00	2.00
Oct. 6	0	0	0	0	0.00	40.00	0	0	0	0	0.00	2.00
Oct. 8	0	1	0	0	0.25	40.25	0	0	0	0	0.00	2.00
Oct. 10	0	0	0	0	0.00	40.25	0	0	0	0	0.00	2.00
Total	24	60	56	21	40.25	40.25	1	6	1	0	2.00	2.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 26. Germination percentages for 3-months-old jointed goatgrass spikelets collected from Condon on July 19, 1983. Germination experiments started October 11, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
Oct. 14	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 16	0	0	0	0	0.00	0.00	10	7	10	12	9.75	9.75
Oct. 18	0	0	0	0	0.00	0.00	6	8	26	12	13.00	22.75
Oct. 20	0	0	0	0	0.00	0.00	4	4	7	5	5.00	27.75
Oct. 22	0	0	0	0	0.00	0.00	0	0	0	1	0.25	28.00
Oct. 24	0	0	0	0	0.00	0.00	1	0	0	1	0.50	28.50
Oct. 26	0	0	0	0	0.00	0.00	0	1	2	0	0.75	29.25
Oct. 28	1	1	0	0	0.50	0.50	0	0	0	0	0.00	29.25
Oct. 30	2	3	1	0	1.50	2.00	0	0	0	2	0.50	29.75
Nov. 1	3	2	3	2	2.50	4.50	1	0	0	0	0.25	30.00
Nov. 3	1	3	3	0	1.75	6.25	0	1	0	0	0.25	30.25
Nov. 5	1	1	1	1	1.00	7.25	0	0	0	0	0.00	30.25
Nov. 7	5	0	1	2	2.00	9.25	0	0	0	0	0.00	30.25
Total	13	10	9	5	9.25	9.25	22	21	45	33	30.25	30.25

(continued)

Appendix Table 26. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
Oct. 14	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 16	16	5	22	5	12.00	12.00	0	0	0	0	0.00	0.00
Oct. 18	12	15	19	7	13.25	25.25	0	0	1	0	0.25	0.25
Oct. 20	7	3	4	3	4.25	29.50	1	1	0	2	1.00	1.25
Oct. 22	3	2	0	1	1.50	31.00	0	0	0	0	0.00	1.25
Oct. 24	0	1	1	2	1.00	32.00	0	1	2	0	0.75	2.00
Oct. 26	0	0	0	0	0.00	32.00	0	0	0	1	0.25	2.25
Oct. 28	1	3	0	0	1.00	33.00	0	0	0	0	0.00	2.25
Oct. 30	1	0	0	1	0.50	33.50	1	0	0	0	0.25	2.50
Nov. 1	0	1	0	0	0.25	33.75	0	1	0	0	0.25	2.75
Nov. 3	0	0	0	0	0.00	33.75	0	0	0	0	0.00	2.75
Nov. 5	0	0	0	0	0.00	33.75	0	0	0	0	0.00	2.75
Nov. 7	0	0	0	0	0.00	33.75	0	0	0	0	0.00	2.75
Total	40	30	46	19	33.75	33.75	2	3	3	3	2.75	2.75

¹No germination occurred at 38 C. Data not shown.

Appendix Table 27. Germination percentages for 4-months-old jointed goatgrass spikelets collected from Condon on July 19, 1983. Germination experiments started November 19, 1983.¹

Date (1983)	Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Nov. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov. 13	0	0	0	0	0.00	0.00	1	9	12	3	6.25	6.25
Nov. 15	0	0	0	0	0.00	0.00	33	10	8	22	18.25	24.50
Nov. 17	0	0	0	0	0.00	0.00	3	0	2	5	2.50	27.00
Nov. 19	0	0	0	0	0.00	0.00	1	2	1	1	1.25	28.25
Nov. 21	0	0	0	0	0.00	0.00	1	0	0	0	0.25	28.50
Nov. 23	0	0	0	0	0.00	0.00	1	0	0	1	0.50	29.00
Nov. 25	0	0	1	2	0.75	0.75	0	0	0	0	0.00	29.00
Nov. 27	1	0	0	5	1.50	2.25	1	0	0	0	0.25	29.25
Nov. 29	3	1	5	0	2.25	4.50	0	0	0	0	0.00	29.25
Dec. 1	0	1	0	1	0.50	5.00	0	0	0	0	0.00	29.25
Dec. 3	0	1	2	0	0.75	5.75	3	2	9	8	5.50	34.75
Dec. 5	0	0	0	0	0.00	5.75	0	0	0	0	0.00	34.75
Total	4	3	8	8	5.75	5.75	44	23	32	40	34.75	34.75

(continued)

Appendix Table 27. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Nov. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov. 13	6	11	7	10	8.50	8.50	0	0	0	0	0.00	0.00
Nov. 15	12	5	11	6	8.50	17.00	2	2	4	2	2.50	2.50
Nov. 17	5	4	4	3	4.00	21.00	3	13	3	6	6.25	8.75
Nov. 19	2	3	0	0	1.25	22.25	4	6	2	3	3.75	12.50
Nov. 21	0	0	0	2	0.50	22.75	0	2	1	2	1.25	13.75
Nov. 23	0	0	0	0	0.00	22.75	1	1	1	1	1.00	14.75
Nov. 25	0	0	0	1	0.25	23.00	0	0	1	1	0.50	15.25
Nov. 27	0	2	1	0	0.75	23.75	0	1	2	0	0.75	16.00
Nov. 29	1	0	0	0	0.25	24.00	1	1	0	3	1.25	17.25
Dec. 1	0	0	0	0	0.00	24.00	1	1	0	2	1.00	18.25
Dec. 3	0	0	0	0	0.00	24.00	1	0	0	1	0.50	18.75
Dec. 5	0	0	0	0	0.00	24.00	0	0	1	0	0.25	19.00
Total	26	25	23	22	24.00	24.00	13	27	15	21	19.00	19.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 28. Germination percentages for 12-months-old jointed goatgrass spikelets collected from Condon on July 19, 1983. Germination experiments started August 8, 1983.¹

Date (1984)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	0	0	0	0	0.00	0.00	17	9	6	11	10.75	10.75
Aug. 13	0	0	0	0	0.00	0.00	1	4	4	4	3.25	14.00
Aug. 15	0	0	0	0	0.00	0.00	3	1	5	5	3.50	17.50
Aug. 17	0	0	0	0	0.00	0.00	3	2	6	3	3.50	21.00
Aug. 19	0	0	0	0	0.00	0.00	3	0	2	0	1.25	22.25
Aug. 21	0	1	0	0	0.25	0.25	0	0	0	1	0.25	22.50
Aug. 23	0	2	0	0	0.50	0.75	1	1	2	1	1.25	23.75
Aug. 25	0	1	0	0	0.25	1.00	0	1	1	1	0.75	24.50
Aug. 27	0	2	3	1	1.50	2.50	0	0	1	0	0.25	24.75
Aug. 29	0	0	2	0	0.50	3.00	0	0	0	0	0.00	24.75
Aug. 31	2	4	7	0	3.25	6.25	1	1	0	0	0.50	25.25
Sept. 2	1	4	1	1	1.75	8.00	0	1	1	0	0.50	25.75
Sept. 4	0	0	5	1	1.50	9.50	0	0	0	0	0.00	25.75
Total	3	14	18	3	9.50	9.50	29	20	28	26	25.75	25.75

(continued)

Appendix Table 28. (continued)

Date (1984)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	31	5	3	26	16.25	16.25	32	7	10	28	19.25	19.25
Aug. 13	6	0	0	26	8.00	24.25	33	6	1	14	13.50	32.75
Aug. 15	2	1	1	4	2.00	26.25	1	0	1	0	0.50	33.25
Aug. 17	0	0	1	0	0.25	26.50	0	0	1	0	0.25	33.50
Aug. 19	0	0	0	0	0.00	26.50	2	0	1	1	1.00	34.50
Aug. 21	0	0	0	2	0.50	27.00	0	0	0	0	0.00	34.50
Aug. 23	0	0	0	0	0.00	27.00	0	0	0	0	0.00	34.50
Aug. 25	0	0	0	0	0.00	27.00	0	0	0	0	0.00	34.50
Aug. 27	0	0	0	0	0.00	27.00	1	0	0	0	0.25	34.75
Aug. 29	0	0	0	0	0.00	27.00	0	0	0	0	0.00	34.75
Aug. 31	0	0	0	0	0.00	27.00	0	0	0	0	0.00	34.75
Sept. 2	0	0	0	0	0.00	27.00	0	0	0	0	0.00	34.75
Sept. 4	0	0	0	0	0.00	27.00	0	0	0	0	0.00	34.75
Total	39	6	5	58	27.00	27.00	69	13	14	43	34.75	34.75

¹No germination occurred at 38 C. Data not shown.

Appendix Table 29. Germination percentages for 0-months-old jointed goatgrass spikelets collected from Elgin on August 2, 1983. Germination experiments started August 3, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 17	0	1	0	0	0.25	0.25	0	0	0	0	0.00	0.00
Aug. 19	3	6	0	0	2.25	2.50	0	0	1	0	0.25	0.25
Aug. 21	2	1	2	0	1.25	3.75	0	0	0	0	0.00	0.25
Aug. 23	0	3	2	1	1.50	5.25	0	1	0	0	0.25	0.50
Aug. 25	2	2	1	0	1.25	6.50	1	1	0	0	0.50	1.00
Aug. 27	0	3	3	2	2.00	8.50	0	0	0	0	0.00	1.00
Aug. 29	1	0	3	0	1.00	9.50	1	0	0	0	0.25	1.25
Total	8	16	11	3	9.50	9.50	2	2	1	0	1.25	1.25

(continued)

Appendix Table 29. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
Aug. 5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 9	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 11	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 13	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 15	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 17	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 19	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 21	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 23	0	0	0	1	0.25	0.25	0	0	0	0	0.00	0.00
Aug. 25	0	0	0	0	0.00	0.25	0	0	0	0	0.00	0.00
Aug. 27	0	0	0	0	0.00	0.25	0	0	0	0	0.00	0.00
Aug. 29	0	0	0	0	0.00	0.25	0	0	0	0	0.00	0.00
Total	0	0	0	1	0.25	0.25	0	0	0	0	0.00	0.00

¹No germination occurred at 38 C. Data not shown.

Appendix Table 30. Germination percentages for 0.5-months-old jointed goatgrass spikelets collected from Elgin on August 2, 1983. Germination experiments started August 16, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
------(%)-----												
Aug. 19	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 21	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 23	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 25	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 27	0	0	0	0	0.00	0.00	1	0	1	0	0.50	0.50
Aug. 29	0	0	0	1	0.25	0.25	2	1	1	0	1.00	1.50
Aug. 31	2	2	6	3	3.25	3.50	5	1	1	0	1.75	3.25
Sept. 2	9	10	17	20	14.00	17.50	5	5	2	1	3.25	6.50
Sept. 4	18	10	22	25	18.75	36.25	11	7	4	0	5.50	12.00
Sept. 6	5	1	5	10	5.25	41.50	9	12	6	1	7.00	19.00
Sept. 8	5	3	4	4	4.00	45.50	8	9	5	2	6.00	25.00
Sept. 10	7	0	4	2	3.25	48.75	5	0	10	1	4.00	29.00
Sept. 12	0	0	2	2	1.00	49.75	4	7	2	3	4.00	33.00
Total	46	26	60	67	49.75	49.75	50	42	32	8	33.00	33.00

(continued)

Appendix Table 30. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 19	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 21	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 23	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 25	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 27	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug. 29	0	0	1	0	0.25	0.25	0	0	0	0	0.00	0.00
Aug. 31	0	1	5	0	1.50	1.75	1	0	1	0	0.50	0.50
Sept. 2	0	1	3	0	1.00	2.75	2	0	0	0	0.50	1.00
Sept. 4	0	3	0	1	1.00	3.75	0	0	0	0	0.00	1.00
Sept. 6	0	4	3	0	1.75	5.50	0	1	1	0	0.50	1.50
Sept. 8	1	5	9	1	4.00	9.50	0	0	0	1	0.25	1.75
Sept. 10	2	9	11	2	6.00	15.50	0	2	0	0	0.50	2.25
Sept. 12	1	7	7	5	5.00	20.50	0	1	0	0	0.25	2.50
Total	4	30	39	9	20.50	20.50	3	4	2	1	2.50	2.50

¹No germination occurred at 38 C. Data not shown.

Appendix Table 31. Germination percentages for 1-month-old jointed goatgrass spikelets collected from Elgin on August 2, 1983. Germination experiments started August 30, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Sept. 2	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 4	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 6	0	0	0	0	0.00	0.00	0	0	1	0	0.25	0.25
Sept. 8	0	0	0	0	0.00	0.00	1	0	15	7	5.75	6.00
Sept. 10	0	0	0	0	0.00	0.00	5	6	14	33	14.50	20.50
Sept. 12	0	0	0	0	0.00	0.00	4	2	9	10	6.25	26.75
Sept. 14	2	2	0	1	1.25	1.25	4	3	19	8	8.50	35.25
Sept. 16	18	22	9	3	13.00	14.25	7	4	4	9	6.00	41.25
Sept. 18	17	18	10	13	14.50	28.75	2	0	4	3	2.25	43.50
Sept. 20	4	3	5	9	5.25	34.00	1	1	0	0	0.50	44.00
Sept. 22	1	7	7	1	4.00	38.00	3	0	1	1	1.25	45.25
Sept. 24	4	3	2	2	2.75	40.75	1	0	0	1	0.50	45.75
Sept. 26	3	1	1	2	1.75	42.50	0	0	0	0	0.00	45.75
Total	49	56	34	31	42.50	42.50	28	16	67	72	45.75	45.75

(continued)

Appendix Table 31. (continued)

Date (1983)	-----Temperature-----											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Sept. 2	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 4	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 6	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Sept. 8	4	5	4	11	6.00	6.00	0	0	0	0	0.00	0.00
Sept. 10	10	13	5	35	15.75	21.75	0	0	0	0	0.00	0.00
Sept. 12	26	10	8	17	15.25	37.00	0	0	0	0	0.00	0.00
Sept. 14	13	12	8	6	9.75	46.75	0	0	0	0	0.00	0.00
Sept. 16	11	5	2	9	6.75	53.50	0	0	0	0	0.00	0.00
Sept. 18	4	5	1	2	3.00	56.50	0	0	0	0	0.00	0.00
Sept. 20	1	5	1	0	1.75	58.25	0	0	0	0	0.00	0.00
Sept. 22	0	1	3	0	1.00	59.25	0	0	0	0	0.00	0.00
Sept. 24	4	1	1	0	1.50	60.75	0	0	0	0	0.00	0.00
Sept. 26	0	1	1	1	0.75	61.50	0	1	0	0	0.25	0.25
Total	73	58	34	81	61.50	61.50	0	1	0	0	0.25	0.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 32. Germination percentages for 2-months-old jointed goatgrass spikelets collected from Elgin on August 2, 1983. Germination experiments started September 27, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Sept. 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 2	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 4	0	0	0	0	0.00	0.00	0	2	0	1	0.75	0.75
Oct. 6	0	0	0	0	0.00	0.00	1	3	0	2	1.50	2.25
Oct. 8	0	0	0	0	0.00	0.00	0	4	0	4	2.00	4.25
Oct. 10	0	0	0	0	0.00	0.00	1	1	2	1	1.25	5.50
Oct. 12	0	0	1	0	0.25	0.25	0	0	1	2	0.75	6.25
Oct. 14	0	1	4	4	2.25	2.50	0	2	0	0	0.50	6.75
Oct. 16	7	6	9	6	7.00	9.50	1	1	0	0	0.50	7.25
Oct. 18	3	4	1	2	2.50	12.00	0	0	0	0	0.00	7.25
Oct. 20	4	3	2	3	3.00	15.00	0	0	0	0	0.00	7.25
Oct. 22	0	1	1	1	0.75	15.75	0	1	0	0	0.25	7.50
Oct. 24	0	1	2	2	1.25	17.00	0	0	0	0	0.00	7.50
Total	14	16	20	18	17.00	17.00	3	14	3	10	7.50	7.50

(Continued)

Appendix Table 32. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
------(%)-----												
Sept. 30	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 2	0	1	0	0	0.25	0.25	0	0	0	0	0.00	0.00
Oct. 4	1	4	2	2	2.25	2.50	0	0	0	0	0.00	0.00
Oct. 6	1	9	4	15	7.25	9.75	0	1	0	0	0.25	0.25
Oct. 8	1	8	4	8	5.25	15.00	0	1	0	0	0.25	0.50
Oct. 10	0	3	2	3	2.00	17.00	1	0	0	0	0.25	0.75
Oct. 12	1	1	2	2	1.50	18.50	0	0	0	0	0.00	0.75
Oct. 14	1	0	1	2	1.00	19.50	1	0	0	0	0.25	1.00
Oct. 16	0	1	1	1	0.75	20.25	0	0	1	0	0.25	1.25
Oct. 18	0	1	1	0	0.50	20.75	0	0	0	0	0.00	1.25
Oct. 20	1	0	0	0	0.25	21.00	0	0	0	0	0.00	1.25
Oct. 22	0	0	0	0	0.00	21.00	0	0	0	0	0.00	1.25
Oct. 24	0	0	0	0	0.00	21.00	0	1	0	0	0.25	1.50
Total	6	28	17	33	21.00	21.00	2	3	1	0	1.50	1.50

¹No germination occurred at 38 C. Data not shown.

Appendix Table 33. Germination percentages for 3-months-old jointed goatgrass spikelets collected from Elgin on August 2, 1983. Germination experiments started October 25, 1983.¹

Date (1983)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 28	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 30	0	0	0	0	0.00	0.00	0	2	0	1	0.75	0.75
Nov. 1	0	0	0	0	0.00	0.00	7	9	9	33	14.50	15.25
Nov. 3	0	0	0	0	0.00	0.00	8	16	6	12	10.50	25.75
Nov. 5	0	0	0	0	0.00	0.00	6	4	7	5	5.50	31.25
Nov. 7	0	0	0	0	0.00	0.00	2	1	4	0	1.75	33.00
Nov. 9	2	1	0	2	1.25	1.25	0	1	0	1	0.50	33.50
Nov. 11	16	4	9	2	7.75	9.00	2	3	1	1	1.75	35.25
Nov. 13	22	8	14	5	12.25	21.25	0	0	0	0	0.00	35.25
Nov. 15	7	4	8	2	5.25	26.50	0	0	0	0	0.00	35.25
Nov. 17	5	2	0	0	1.75	28.25	0	0	0	0	0.00	35.25
Nov. 19	2	3	3	1	2.25	30.50	0	1	0	0	0.25	35.50
Nov. 21	4	1	1	1	1.75	32.25	0	0	0	0	0.00	35.50
Total	58	23	35	13	32.25	32.25	25	37	27	53	35.50	35.50

(continued)

Appendix Table 33. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Oct. 28	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct. 30	8	3	9	17	9.25	9.25	0	0	0	0	0.00	0.00
Nov. 1	25	2	21	22	17.50	26.75	1	2	0	5	2.00	2.00
Nov. 3	4	3	11	13	7.75	34.50	1	7	4	7	4.75	6.75
Nov. 5	6	2	3	3	3.50	38.00	6	3	4	7	5.00	11.75
Nov. 7	0	1	0	0	0.25	38.25	3	3	2	2	2.50	14.25
Nov. 9	1	0	0	1	0.50	38.75	3	1	0	3	1.75	16.00
Nov. 11	0	0	1	1	0.50	39.25	1	1	0	3	1.25	17.25
Nov. 13	1	0	1	0	0.50	39.75	3	1	2	1	1.75	19.00
Nov. 15	0	0	0	0	0.00	39.75	0	3	2	0	1.25	20.25
Nov. 17	0	0	0	0	0.00	39.75	0	1	0	2	0.75	21.00
Nov. 19	0	0	0	0	0.00	39.75	0	1	2	0	0.75	21.75
Nov. 21	0	0	0	0	0.00	39.75	0	0	0	0	0.00	21.75
Total	45	11	46	57	39.75	39.75	18	23	16	30	21.75	21.75

¹No germination occurred at 38 C. Data not shown.

Appendix Table 34. Germination percentages for 4-months-old jointed goatgrass spikelets collected from Elgin on August 2, 1983. Germination experiments started November 22, 1983.¹

Date (1983)	-----Temperature-----											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Nov. 25	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov. 27	0	0	0	0	0.00	0.00	7	3	1	2	3.25	3.25
Nov. 29	0	0	0	0	0.00	0.00	7	6	4	4	5.25	8.50
Dec. 1	0	0	0	0	0.00	0.00	6	2	5	0	3.25	11.75
Dec. 3	0	0	0	0	0.00	0.00	0	1	2	2	1.25	13.00
Dec. 5	2	0	0	0	0.50	0.50	0	0	0	0	0.00	13.00
Dec. 7	2	1	2	1	1.50	2.00	0	1	0	1	0.50	13.50
Dec. 9	10	3	5	4	5.50	7.50	0	0	2	0	0.50	14.00
Dec. 11	8	6	7	11	8.00	15.50	1	0	0	1	0.50	14.50
Dec. 13	3	3	1	6	3.25	18.75	0	0	0	0	0.00	14.50
Dec. 15	3	2	2	3	2.50	21.25	0	0	0	1	0.25	14.75
Dec. 17	1	2	2	2	1.75	23.00	0	0	0	0	0.00	14.75
Dec. 19	1	3	1	2	1.75	24.75	0	0	0	0	0.00	14.75
Total	30	20	20	29	24.75	24.75	21	13	14	11	14.75	14.75

(continued)

Appendix Table 34. (continued)

Date (1983)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Nov. 25	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov. 27	1	0	1	1	0.75	0.75	0	0	0	0	0.00	0.00
Nov. 29	8	3	1	8	5.00	5.75	11	6	0	1	4.50	4.50
Dec. 1	1	1	4	1	1.75	7.50	11	8	0	4	5.75	10.25
Dec. 3	3	1	4	3	2.75	10.25	5	9	5	10	7.25	17.50
Dec. 5	3	0	4	3	2.50	12.75	5	7	1	5	4.50	22.00
Dec. 7	0	0	0	0	0.00	12.75	2	1	1	1	1.25	23.25
Dec. 9	5	1	1	2	2.25	15.00	1	5	0	0	1.50	24.75
Dec. 11	2	1	3	2	2.00	17.00	0	2	0	0	0.50	25.25
Dec. 13	1	2	1	1	1.25	18.25	0	0	0	0	0.00	25.25
Dec. 15	1	0	0	0	0.25	18.50	0	0	0	0	0.00	25.25
Dec. 17	1	0	0	1	0.50	19.00	0	0	0	0	0.00	25.25
Dec. 19	0	0	0	0	0.00	19.00	0	0	0	0	0.00	25.25
Total	26	9	19	22	19.00	19.00	35	38	7	21	25.25	25.25

¹No germination occurred at 38 C. Data not shown.

Appendix Table 35. Germination percentages for 12-months-old jointed goatgrass spikelets collected from Elgin on August 2, 1983. Germination experiments started August 8, 1983.¹

Date (1984)	Temperature											
	7 C						18 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	(%)											
Aug. 11	0	0	0	0	0.00	0.00	18	0	14	8	10.00	10.00
Aug. 13	0	0	0	0	0.00	0.00	4	2	4	3	3.25	13.25
Aug. 15	0	0	0	0	0.00	0.00	6	3	9	4	5.50	18.75
Aug. 17	0	0	0	0	0.00	0.00	4	0	1	4	2.25	21.00
Aug. 19	0	0	0	0	0.00	0.00	1	1	2	3	1.75	22.75
Aug. 21	0	0	0	0	0.00	0.00	0	1	2	1	1.00	23.75
Aug. 23	0	0	0	0	0.00	0.00	1	1	1	0	0.75	24.50
Aug. 25	0	2	2	0	1.00	1.00	0	0	1	0	0.25	24.75
Aug. 27	3	2	5	3	3.25	4.25	1	1	0	1	0.75	25.50
Aug. 29	0	0	0	0	0.00	4.25	0	0	0	0	0.00	25.50
Aug. 31	2	4	9	2	4.25	8.50	0	0	0	0	0.00	25.50
Sept. 2	2	0	1	1	1.00	9.50	0	0	0	0	0.00	25.50
Sept. 4	1	0	1	1	0.75	10.25	0	0	0	0	0.00	25.50
Total	8	8	18	7	10.25	10.25	35	9	34	24	25.50	25.50

(continued)

Appendix Table 35. (continued)

Date (1984)	Temperature											
	23 C						29 C					
	R1	R2	R3	R4	Mean	Cum. Mean	R1	R2	R3	R4	Mean	Cum. Mean
	------(%)-----											
Aug. 11	11	10	1	49	17.75	17.75	48	43	43	8	35.50	35.50
Aug. 13	7	7	1	13	7.00	24.75	6	9	5	1	5.25	40.75
Aug. 15	1	1	2	4	2.00	26.75	0	1	1	2	1.00	41.75
Aug. 17	0	0	0	1	0.25	27.00	0	0	0	1	0.25	42.00
Aug. 19	1	1	0	1	0.75	27.75	0	0	0	0	0.00	42.00
Aug. 21	0	0	1	0	0.25	28.00	0	0	0	0	0.00	42.00
Aug. 23	0	0	0	0	0.00	28.00	0	0	0	0	0.00	42.00
Aug. 25	0	0	0	0	0.00	28.00	0	0	0	0	0.00	42.00
Aug. 27	0	0	0	0	0.00	28.00	0	0	0	0	0.00	42.00
Aug. 29	0	0	0	0	0.00	28.00	0	0	0	0	0.00	42.00
Aug. 31	0	0	0	0	0.00	28.00	0	0	0	0	0.00	42.00
Sept. 2	0	0	0	0	0.00	28.00	0	0	0	0	0.00	42.00
Sept. 4	0	0	0	0	0.00	28.00	0	0	0	0	0.00	42.00
Total	20	19	5	68	28.00	28.00	54	53	49	12	42.00	42.00

¹No germination occurred at 38 C. Data not shown.

Table 36. Analysis of variance table for percent germination data (arcsin percentage transformation) on jointed goatgrass spikelets collected from Echo on July 5, 1983.

Source of variation	df	SS	MS	F
Treatment	34	56528.44	1662.60	34.36**
Temp.	(4)	29385.40	7346.35	151.82**
Age	(6)	15437.76	2572.96	53.17**
Temp. x Age	(24)	11705.28	487.72	10.08**
Error	105	5080.95	48.39	
Total	139	61609.39		

** = significant at 1% level.

cv = 27.8%

Table 37. Analysis of variance table for percent germination data (arcsin percentage transformation) on jointed goatgrass spikelets collected from Ione on July 7, 1983.

Source of variation	df	SS	MS	F
Treatment	34	47431.02	1395.03	29.74**
Temp.	(4)	23178.48	5794.62	123.55**
Age	(6)	12705.42	2117.57	45.15**
Temp. x Age	(24)	11547.12	481.13	10.26**
Error	105	4924.50	46.90	
Total	139	52355.52		

** = significant at 1% level.

cv = 28.8%

Table 38. Analysis of variance table for percent germination data (arcsin percentage transformation) on jointed goatgrass spikelets collected from Pendleton on July 13, 1983.

Source of variation	df	SS	MS	F
Treatment	34	49058.54	1442.90	30.38**
Temp.	(4)	22431.92	5607.98	118.09**
Age	(6)	14898.06	2483.01	52.28**
Temp. x Age	(24)	11728.56	488.69	10.29**
Error	105	4986.45	47.49	
Total	139	54044.99		

** = significant at 1% level.

cv = 28.4%

Table 39. Analysis of variance table for percent germination data (arcsin percentage transformation) on jointed goatgrass spikelets collected from Condon on July 19, 1983.

Source of variation	df	SS	MS	F
Treatment	34	33078.54	972.90	20.23**
Temp.	(4)	13282.92	3320.73	69.05**
Age	(6)	7692.66	1282.11	26.66**
Temp. x Age	(24)	12102.96	504.29	10.49**
Error	105	5049.45	48.09	
Total	139	38127.99		

** = significant at 1% level.

cv = 42.3%

Table 40. Analysis of variance table for percent germination data (arcsin percentage transformation) on jointed goatgrass spikelets collected from Elgin on August 2, 1983.

Source of variation	df	SS	MS	F
Treatment	34	35400.44	1041.19	15.92**
Temp.	(4)	17221.40	4305.35	65.82**
Age	(6)	7693.44	1282.24	19.60**
Temp. x Age	(24)	10485.60	436.90	6.68**
Error	105	6868.05	65.41	
Total	139	42268.49		

** = significant at 1% level.

cv = 39.9%

Appendix Table 41. Analysis of variance table for germination rate data on jointed goatgrass spikelets collected from Echo on July 5, 1983.

Source of variation	df	SS	MS	F
Treatment	34	2095.61	61.64	14.37**
Temp.	(4)	389.90	97.47	22.73**
Age	(6)	726.76	121.13	28.25**
Temp. x Age	(24)	978.95	40.79	9.51**
Error	105	450.19	4.29	
Total	139	2545.80		

** = significant at 1% level.

Appendix Table 42. Analysis of variance table for germination rate data on jointed goatgrass spikelets collected from Ione on July 7, 1983.

Source of variation	df	SS	MS	F
Treatment	34	3288.14	96.71	32.78**
Temp.	(4)	577.99	235.00	48.94**
Age	(6)	1409.98	54.17	79.60**
Temp. x Age	(24)	1300.17	2.95	18.35**
Error	105	309.97	46.90	
Total	139	3598.11		

** = significant at 1% level.

Appendix Table 43. Analysis of variance table for germination rate data on jointed goatgrass spikelets collected from Pendleton on July 13, 1983.

Source of variation	df	SS	MS	F
Treatment	34	2852.05	83.88	19.15**
Temp.	(4)	696.10	174.03	39.77**
Age	(6)	1026.40	171.07	39.09**
Temp. x Age	(24)	1129.55	47.64	10.75**
Error	105	459.50	4.38	
Total	139	3311.55		

** = significant at 1% level.

Appendix Table 44. Analysis of variance table for germination rate data on jointed goatgrass spikelets collected from Condon on July 19, 1983.

Source of variation	df	SS	MS	F
Treatment	34	840.43	24.72	7.02**
Temp.	(4)	216.68	54.17	15.39**
Age	(6)	269.44	44.91	12.76**
Temp. x Age	(24)	354.31	14.76	4.20**
Error	105	369.47	3.52	
Total	139	1209.9		

** = significant at 1% level.

Appendix Table 45. Analysis of variance table for germination rate data on jointed goatgrass spikelets collected from Elgin on August 2, 1983.

Source of variation	df	SS	MS	F
Treatment	34	1023.34	31.00	6.92**
Temp.	(4)	181.16	45.29	10.41**
Age	(6)	356.78	59.46	13.66**
Temp. x Age	(24)	485.40	20.22	4.65**
Error	105	456.97	4.35	
Total	139	1480.31		

** = significant at 1% level.

Appendix Table 46. Stand count per meter of row for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984^a.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (gm) -----				
Echo	28	25	36	31	30
Ione	40	35	44	40	40
Pendleton	33	39	33	41	37
Condon	34	32	36	31	33
Elgin	44	38	41	48	43

^aCounted at two-leaf stage on November 22, 1983.

Analysis of variance table for stand count per meter of row data in Appendix Table 46.

Source of variation	df	SS	MS	F
Replication	3	64.55	21.51	
Treatment	4	409.70	102.42	7.56*
Error	12	162.70	13.55	
Total	19	636.95		

* = significant at 5% level.

cv = 10.1%

Appendix Table 47. Leaf and stem dry weights at anthesis for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984^a.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (gm) -----				
Echo	261	336	231	404	308
Ione	282	377	403	421	371
Pendleton	288	425	405	393	378
Condon	343	333	407	404	372
Elgin	386	363	395	378	381

^aPlants harvested June 22, 1984.

Analysis of variance table for leaf and stem dry weights at anthesis data in Appendix Table 47.

Source of variation	df	SS	MS	F
Replication	3	20026.15	6675.38	
Treatment	4	14710.50	3677.62	1.70 ^{ns}
Error	12	26019.10	2168.25	
Total	19	60755.75		

ns = not significant.

cv = 12.9%

Appendix Table 48. Plants per meter of row for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (no.) -----				
Echo	17	22	21	23	21
Ione	29	28	29	23	27
Pendleton	30	28	28	31	29
Condon	26	24	28	25	26
Elgin	27	28	32	33	30

Analysis of variance table for plants per meter of row data in Appendix Table 48.

Source of variation	df	SS	MS	F
Replication	3	12.15	4.05	
Treatment	4	227.70	56.92	9.34*
Error	12	73.10	6.09	
Total	19	312.95		

* = significant at 5% level.

cv = 9.3%

Appendix Table 49. Spikes per plant for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (no.) -----				
Echo	29	37	44	15	31
Ione	22	28	23	35	27
Pendleton	15	21	24	23	21
Condon	22	26	23	21	28
Elgin	24	26	23	21	23

Analysis of variance table for spikes per plant data in Appendix Table 49.

Source of variation	df	SS	MS	F
Replication	3	106.53	35.51	
Treatment	4	254.76	63.69	1.14 ^{ns}
Error	12	667.12	55.59	
Total	19	1028.42		

ns = not significant.

cv = 28.7%

Appendix Table 50. Spikelets per spike for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (no.) -----				
Echo	8.4	8.5	8.5	8.1	8.4
Ione	8.5	8.3	8.5	8.4	8.4
Pendleton	8.2	8.0	8.2	8.3	8.2
Condon	7.6	7.9	7.8	8.0	7.8
Elgin	8.5	8.0	8.1	8.3	8.2

Analysis of variance table for spikelets per spike data in Appendix Table 50.

Source of variation	df	SS	MS	F
Replication	3	0.04	0.01	
Treatment	4	0.83	0.21	6.38*
Error	12	0.39	0.03	
Total	19	1.25		

* = significant at 5% level.

cv = 2.2%

Appendix Table 51. Spikelets per plant for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (no.) -----				
Echo	238	312	374	125	262
Ione	188	234	200	295	229
Pendleton	123	171	199	196	172
Condon	168	224	183	300	219
Elgin	202	204	182	180	192

Analysis of variance table for spikelets per plant Appendix Table 51.

Source of variation	df	SS	MS	F
Replication	3	6802.36	2267.45	
Treatment	4	19150.53	4787.63	1.17 ^{ns}
Error	12	49261.11	4105.09	
Total	19	75214.01		

ns = not significant.

cv = 29.8%

Appendix Table 52. Plant height for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (cm) -----				
Echo	68	68	67	68	68
Ione	67	68	74	73	70
Pendleton	69	73	71	75	72
Condon	78	75	81	78	78
Elgin	67	74	68	72	71

Analysis of variance table for plant height data in Appendix Table 52.

Source of variation	df	SS	MS	F
Replication	3	24.40	8.13	
Treatment	4	244.30	61.07	9.61**
Error	12	76.25	6.35	
Total	19	344.96		

** = significant at 1% level.

cv = 3.5%

Appendix Table 53. Weight per spikelet for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (no.) -----				
Echo	22.1	23.5	24.1	23.5	23.3
Ione	37.8	33.9	33.6	31.8	34.3
Pendleton	45.3	42.1	46.1	47.1	45.1
Condon	53.7	52.3	46.5	49.2	50.4
Elgin	55.5	48.8	46.4	50.7	50.4

Analysis of variance table for weight per spikelet (1983) data in Appendix Table 53.

Source of variation	df	SS	MS	F
Replication	3	3484.28	1161.42	
Treatment	4	220625.76	55156.44	86.37**
Error	12	7662.84	638.57	
Total	19	23177289.75		

** = significant at 1% level.

cv = 6.2%

Appendix Table 54. Weight per spikelet for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (no.) -----				
Echo	48.1	50.0	48.3	47.8	48.5
Ione	47.3	40.0	40.0	42.4	42.4
Pendleton	50.6	39.7	37.7	44.9	43.2
Condon	57.0	50.3	47.3	45.8	50.1
Elgin	46.1	38.7	42.2	41.2	42.0

Analysis of variance table for weight per spikelet (1984) data in Appendix Table 54.

Source of variation	df	SS	MS	F
Replication	3	14598.14	4866.04	
Treatment	4	22537.92	5634.48	6.98**
Error	12	9693.38	807.78	
Total	19	4682945.20		

** = significant at 1% level.

cv = 6.3%

Appendix Table 55. Visual evaluation of lodging for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984^a.

Collection site	Replication				Mean
	I	II	III	IV	
	------(%)-----				
Echo	30	60	30	50	42
Ione	80	95	85	95	89
Pendleton	50	75	98	98	80
Condon	90	98	95	90	93
Elgin	90	95	90	95	93

^avisual evaluation scale: 0 = no lodging; 100 = complete lodging.

Appendix Table 56. Visual evaluation of stripe rust infection for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984^{ab}.

Collection site	Replication				Mean
	I	II	III	IV	
	------(%)-----				
Echo	99	95	95	95	96
Ione	99	98	98	95	98
Pendleton	99	98	98	98	98
Condon	99	98	90	98	96
Elgin	95	98	98	98	97

^aData are means of 5 flag leaves.

^bvisual evaluation scale: 0 = no visible signs or symptoms; 100 = necrosis or chlorosis may or may not be present, abundant sporulation.

Appendix Table 57. Total yield (spikelet and straw) for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (kg/ha) -----				
Echo	4484	4573	4292	3981	4333
Ione	4306	4911	5271	4421	4727
Pendleton	4228	4934	4639	4726	4632
Condon	4421	4715	4738	4721	4649
Elgin	4422	4640	4938	4268	4567

Analysis of variance table for total yield (spikelet and straw) data in Appendix Table 57.

Source of variation	df	SS	MS	F
Replication	3	685880.00	228630.00	
Treatment	4	366320.00	91579.00	1.54 ^{ns}
Error	12	713300.00	59441.67	
Total	19	1765500.00		

ns = not significant.

cv = 5.3%

Appendix Table 58. Straw yield for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (kg/ha) -----				
Echo	2452	2524	2464	2235	2419
Ione	2534	2950	3201	2710	2850
Pendleton	2707	3190	3012	3023	2983
Condon	2956	2986	3159	3044	3036
Elgin	2673	2978	3080	2678	2852

Analysis of variance table for straw yield data in Appendix Table 58.

Source of variation	df	SS	MS	F
Replication	3	338090.00	112700.00	
Treatment	4	941140.00	235280.00	12.0**
Error	12	235170.00	19597.50	
Total	19	1514400.00		

** = significant at 1% level.

cv = 5.0%

Appendix Table 59. Spikelet yield for jointed goatgrass accessions collected from eastern and north-central Oregon in 1983, and grown at Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1983-1984.

Collection site	Replication				Mean
	I	II	III	IV	
	----- (kg/ha) -----				
Echo	2032	2050	1828	1746	1914
Ione	1767	1961	2071	1710	1877
Pendleton	1520	1743	1627	1703	1648
Condon	1465	1730	1579	1677	1613
Elgin	1749	1662	1858	1590	1715

Analysis of variance table for spikelet yield data in Appendix Table 59.

Source of variation	df	SS	MS	F
Replication	3	70619.00	23539.67	
Treatment	4	293856.00	73464.00	4.59*
Error	12	191860.00	15988.33	
Total	19	556335.00		

* = significant at 5% level.

cv = 7.2%

Appendix Table 60. Daily maximum and minimum surface temperature (C) for the period October 1983 to July 1984. Observations taken from Pendleton Branch Experimental Station for the 24-hour period ending at 8:00 a.m.

Date	-----1983-----						-----1984-----			
	October		November		December		January		February	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	17.8	- 3.3	17.2	7.8	2.2	- 5.0	5.6	- 8.3	2.2	- 2.8
2	20.6	6.1	18.3	2.8	2.2	- 2.8	- 3.3	- 8.3	9.4	- 3.3
3	20.6	10.0	18.9	10.0	- 0.6	-10.0	6.1	- 5.6	11.1	- 2.8
4	23.3	10.6	19.4	7.8	- 1.7	- 3.8	10.6	2.8	1.1	- 2.2
5	21.1	- 1.7	13.3	1.7	2.2	- 3.3	13.3	3.3	1.1	- 2.2
6	20.6	0.0	16.1	4.4	1.7	- 2.8	11.7	1.7	0.0	- 2.2
7	19.4	- 3.9	10.0	0.0	- 1.7	-11.1	13.3	- 2.8	11.1	- 1.1
8	17.2	- 2.2	8.3	- 1.1	5.5	- 7.2	6.1	- 2.8	1.1	- 1.1
9	18.3	5.6	12.2	- 0.6	8.3	- 0.6	8.3	- 2.2	8.9	- 1.1
10	16.7	8.3	11.7	7.2	10.6	0.0	3.9	- 1.7	7.8	0.0
11	16.1	0.6	15.6	4.4	8.9	0.0	5.6	- 1.1	8.9	- 0.6
12	19.4	0.0	13.3	- 1.7	5.0	- 5.0	7.8	- 2.2	8.3	3.3
13	18.9	1.1	12.8	1.7	6.7	- 5.0	1.7	- 2.8	14.4	5.6
14	17.2	6.1	10.0	4.4	9.4	- 2.2	- 1.7	- 5.6	8.3	0.6
15	15.6	- 0.6	11.7	5.6	6.1	1.1	- 3.9	-10.0	8.9	1.7
16	15.6	- 3.3	13.9	7.2	8.9	- 4.4	- 1.1	- 8.9	10.6	2.2
17	17.2	- 1.7	14.4	7.8	- 2.8	- 5.0	- 2.2	-17.2	3.3	- 1.7
18	13.9	- 3.3	13.9	5.0	- 3.3	- 6.7	- 1.7	-12.2	5.0	- 2.2
19	16.7	- 2.2	10.5	0.6	- 5.0	- 7.8	- 1.7	-12.2	9.4	- 2.8
20	15.6	2.8	15.0	1.7	- 5.6	-15.6	- 3.3	-12.8	13.3	- 5.6
21	20.0	1.1	9.4	2.8	- 8.9	-22.2	- 5.6	-12.2	13.9	1.7
22	21.1	0.6	5.0	- 2.2	-12.8	-30.6	3.3	- 6.7	7.8	0.0
23	13.9	2.8	6.1	- 0.6	-15.6	-32.2	7.2	1.7	7.2	0.6
24	15.0	- 1.1	9.4	1.1	-17.8	-31.7	8.9	3.9	8.9	2.8
25	16.7	- 1.7	14.4	1.1	-12.8	-22.8	12.2	3.3	10.6	1.7
26	18.3	- 1.7	7.8	1.7	- 7.2	-13.3	11.7	0.6	6.7	- 2.2
27	20.6	- 1.7	8.3	2.8	- 1.1	-14.4	10.0	1.1	9.4	- 0.6
28	21.1	2.2	10.6	3.3	- 5.0	-18.3	12.8	0.6	13.9	4.4
29	17.2	1.7	4.4	- 0.6	- 8.3	-15.6	13.3	0.0	15.6	1.1
30	20.6	2.2	2.2	- 1.7	- 2.8	- 8.9	10.6	- 2.2		
31	21.7	10.0			2.2	- 7.2	8.3	- 2.8		
AVG.	18.3	1.4	11.8	2.9	- 1.1	-10.2	5.4	- 3.9	8.2	- 0.3

Appendix Table 60. (continued)

Date	-----1984-----									
	March		April		May		June		July	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	10.6	1.7	14.4	2.2	12.2	3.3	17.2	- 1.1	24.4	6.1
2	11.1	2.2	14.4	3.3	13.9	6.7	21.7	6.7	31.1	8.9
3	11.1	- 1.1	14.4	2.2	15.0	5.6	17.8	6.7	28.3	8.9
4	10.0	- 2.8	13.3	5.6	13.9	- 1.1	21.7	9.4	30.0	10.6
5	10.6	- 2.2	14.4	5.6	12.8	1.7	15.6	7.2	33.3	10.6
6	15.0	- 1.7	11.1	1.7	13.3	1.7	18.3	7.8	32.8	9.4
7	15.0	- 1.1	11.7	- 1.1	15.0	2.2	17.8	8.9	26.1	3.3
8	18.3	1.1	15.0	4.4	23.3	11.1	16.1	17.2	27.2	6.1
9	17.2	3.9	10.6	0.0	20.6	6.1	17.2	7.2	28.3	8.3
10	17.8	3.3	12.8	3.9	16.1	7.2	19.4	4.4	29.4	7.8
11	11.7	1.7	11.1	1.1	14.4	7.8	19.4	4.4	33.3	8.9
12	13.9	3.3	11.7	6.1	21.7	8.3	22.8	9.4	32.2	7.2
13	10.0	0.6	13.3	- 1.7	25.6	6.7	22.8	7.8	30.0	9.4
14	11.7	3.3	19.4	1.7	26.7	7.8	24.4	8.3	30.0	8.3
15	12.8	3.9	26.1	10.0	11.7	5.6	27.2	10.6	32.8	9.4
16	12.8	3.9	26.1	3.9	13.3	4.4	26.7	6.1	35.6	11.7
17	13.9	3.3	16.1	6.1	18.9	4.4	21.7	4.4	37.2	12.8
18	12.2	1.7	14.4	2.8	22.2	3.3	23.9	5.0	38.9	15.6
19	9.4	3.9	16.1	6.1	22.2	7.2	25.6	7.2	35.0	11.7
20	15.0	7.2	13.3	2.8	21.7	5.6	26.1	5.0	32.8	7.8
21	19.4	3.3	14.4	0.0	16.1	5.0	15.0	8.9	31.1	7.8
22	9.4	3.3	15.6	6.1	17.2	0.6	15.0	10.6	25.6	4.4
23	14.4	5.6	19.4	5.0	21.1	7.8	24.4	7.2	31.7	14.4
24	13.3	2.8	13.9	0.0	15.6	3.3	28.9	10.6	33.9	17.8
25	12.2	0.0	9.4	0.0	16.1	1.7	31.1	8.9	36.1	17.8
26	10.0	3.9	10.6	- 0.6	16.1	7.8	31.7	14.4	37.8	13.3
27	11.1	2.8	14.4	- 2.2	19.4	2.8	28.3	12.8	33.9	14.4
28	13.3	3.3	15.0	- 3.3	22.2	5.6	31.1	13.3	36.7	14.4
29	11.7	2.2	11.7	3.9	27.8	8.9	33.3	12.2	32.2	13.9
30	10.6	- 1.7	12.2	2.8	31.1	14.4	20.6	3.3	33.9	12.2
31	13.9	0.6			18.3	1.7			35.0	12.8
Avg.	12.9	2.0	14.6	2.6	18.6	5.3	22.8	7.9	32.1	10.5

Appendix Table 61. Daily maximum and minimum soil temperature (C) at 10 cm for the period October 1983 to July 1984. Observations taken from Pendleton Branch Experimental Station for the 24-hour period ending at 8:00 a.m.

Date	-----1983-----						-----1984-----			
	October		November		December		January		February	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	17.2	10.0	13.9	11.7	3.3	2.8	0.0	0.0	2.2	1.1
2	17.8	10.0	12.2	9.4	2.8	2.2	0.0	0.0	3.3	0.6
3	18.9	13.3	12.2	9.4	2.2	2.2	0.0	0.0	3.3	1.1
4	20.0	14.4	12.2	11.7	2.2	2.2	0.0	0.0	1.7	1.1
5	19.4	12.8	12.2	8.9	2.2	1.7	0.0	0.0	1.1	1.1
6	19.4	12.2	10.6	8.3	1.7	1.7	0.0	0.0	1.1	0.6
7	18.3	11.1	10.6	6.1	1.7	1.7	0.0	0.0	3.3	0.6
8	16.7	11.1	7.2	5.6	1.7	1.7	1.1	0.0	1.7	1.1
9	15.0	10.6	8.9	6.1	1.7	1.7	2.2	0.0	2.8	1.1
10	15.6	12.8	7.8	6.7	1.7	1.7	1.1	1.1	2.2	1.7
11	15.6	9.4	8.9	7.8	2.8	1.7	1.1	0.6	2.2	1.1
12	16.7	8.9	10.6	6.7	2.2	2.2	2.2	1.1	2.2	1.1
13	15.6	9.4	7.8	5.6	2.2	1.7	1.1	1.1	5.0	2.2
14	13.9	11.1	6.1	5.0	3.9	2.2	1.1	1.1	4.4	2.8
15	13.3	10.0	6.7	5.0	3.9	3.3	1.1	0.0	4.4	2.2
16	15.0	8.3	8.9	6.7	4.4	2.8	0.0	0.0	5.0	2.8
17	13.9	7.8	8.9	7.8	3.3	2.2	0.0	0.0	3.3	2.2
18	12.2	7.8	8.9	7.2	2.2	1.7	0.0	0.0	3.3	1.7
19	13.9	7.2	8.3	6.1	1.7	1.1	0.0	0.0	5.0	1.7
20	12.8	8.9	7.8	5.0	1.7	1.1	0.0	- 0.6	5.6	1.7
21	15.6	10.0	6.7	5.0	1.7	1.1	- 0.6	- 1.1	5.0	3.3
22	15.6	9.4	6.1	4.4	1.7	1.1	- 1.1	- 1.1	3.9	2.2
23	12.8	10.0	5.0	3.9	1.7	1.1	- 1.1	- 1.1	2.8	1.7
24	13.9	7.8	6.1	4.4	1.7	1.1	- 0.6	- 1.1	5.0	1.7
25	11.1	7.2	7.2	4.4	1.7	1.1	0.0	- 0.6	5.0	2.8
26	12.8	6.7	5.0	3.9	1.1	0.0	1.7	0.0	3.3	2.2
27	12.8	6.7	6.1	4.4	0.0	0.0	2.2	0.6	5.0	1.7
28	13.9	8.3	7.2	5.6	0.0	0.0	4.4	1.7	7.8	2.8
29	13.9	8.9	6.1	4.4	0.0	0.0	4.4	1.7	7.2	3.3
30	13.9	8.3	4.4	2.8	0.0	0.0	5.0	1.7		
31	13.9	10.6			0.0	0.0	3.9	1.7		
Avg.	15.2	9.7	8.3	6.3	1.9	1.4	0.9	0.2	3.7	1.8

Appendix Table 61. (continued)

Date	-----1984-----									
	March		April		May		June		July	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	6.1	3.3	11.1	5.6	11.7	7.2	21.1	12.2	28.3	17.2
2	7.2	3.9	11.7	7.2	10.0	7.2	22.8	12.2	28.9	17.8
3	7.2	3.9	12.8	6.7	12.8	8.3	20.0	14.4	29.4	17.8
4	12.8	2.2	9.4	6.7	12.8	6.7	23.9	13.9	29.4	17.8
5	7.8	3.3	10.0	8.3	11.1	6.1	18.3	13.3	31.7	21.7
6	8.9	3.3	10.0	6.7	10.6	6.7	18.3	12.2	31.7	22.2
7	9.4	3.9	10.6	6.1	13.3	6.1	18.9	13.3	29.4	20.0
8	10.0	3.9	8.9	6.1	18.3	7.2	14.4	11.1	30.0	19.4
9	8.9	5.0	8.9	4.4	15.6	11.1	14.4	11.1	29.4	20.0
10	10.0	7.2	8.3	4.4	15.6	11.1	20.0	11.1	29.4	20.6
11	8.9	6.1	8.9	5.0	15.6	10.6	18.3	11.1	30.6	20.6
12	8.3	5.6	8.9	5.0	16.7	11.7	20.0	12.8	30.0	21.1
13	7.8	5.0	10.0	5.6	20.6	12.2	20.6	13.9	29.4	21.1
14	7.2	5.6	11.1	5.0	22.8	13.3	23.3	14.4	29.4	21.1
15	8.3	5.6	15.0	6.7	16.1	11.7	26.7	15.6	31.1	20.6
16	8.9	6.1	17.8	10.6	13.3	10.0	27.2	17.8	31.7	21.1
17	10.0	6.1	15.0	10.0	19.4	8.9	25.0	16.7	31.7	22.2
18	8.3	5.6	14.4	8.9	21.7	11.1	26.7	16.1	32.2	23.3
19	6.7	5.0	13.3	8.9	21.1	13.3	25.0	16.7	31.1	23.3
20	9.4	6.7	10.6	7.2	16.7	12.8	26.1	16.1	30.6	22.8
21	11.7	7.8	12.8	6.7	17.8	11.7	18.3	13.9	30.0	22.2
22	7.8	6.1	12.2	6.7	20.0	12.2	14.4	13.3	28.3	20.6
23	11.1	6.1	15.6	8.3	17.8	11.7	25.0	13.9	28.9	20.0
24	8.9	6.1	15.0	8.3	16.7	11.1	27.8	15.6	29.4	22.2
25	9.4	4.4	10.0	6.7	16.7	10.6	28.9	13.3	31.1	23.3
26	5.6	5.0	11.7	6.1	14.4	10.0	30.0	19.4	32.8	25.0
27	8.9	5.0	11.7	6.1	15.0	10.0	27.2	18.9	32.8	24.4
28	10.6	5.0	15.0	5.6	21.1	10.0	30.0	19.4	32.8	25.6
29	8.3	5.6	10.6	6.1	23.9	12.8	31.7	21.7	30.0	23.9
30	10.0	5.0	12.2	7.2	26.7	15.6	26.7	17.2	31.1	22.8
31	10.6	4.4			16.7	12.8			31.7	23.3
Avg.	8.9	5.1	11.8	6.8	16.8	10.3	23.1	14.8	30.4	21.4

Appendix Table 62. Daily precipitation (mm) and monthly totals for the period October 1983 to July 1984.
Observations taken from Pendleton Branch Experimental Station for the 24-hour period ending at 8:00 a.m.

Date	-----1983-----			-----1984-----						
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.
1	0.00	5.33	0.00	0.25	0.25	0.25	0.00	6.09	0.00	0.00
2	0.00	6.60	1.02	0.51	0.00	7.37	0.25	7.37	0.00	0.00
3	0.00	2.29	4.32	3.30	0.00	T	0.00	7.62	0.00	0.00
4	T	13.72	0.25	0.25	0.25	0.00	T	T	7.37	0.00
5	0.00	0.00	1.52	T	0.00	0.00	5.84	0.00	7.62	0.00
6	0.00	4.83	9.40	0.00	1.02	0.00	1.52	T	12.45	0.00
7	0.00	5.59	3.81	0.00	T	0.00	0.00	0.00	3.05	0.00
8	0.00	0.25	7.62	0.51	0.25	0.00	16.00	0.00	1.27	0.00
9	13.00	0.51	2.54	0.25	T	0.25	1.27	2.29	0.51	0.00
10	0.25	1.52	2.03	0.00	4.83	T	4.83	0.00	0.25	0.00
11	0.00	2.79	1.02	2.79	0.51	1.78	0.51	1.27	2.54	0.00
12	0.00	0.51	9.65	T	1.27	0.00	1.02	0.25	0.00	0.00
13	0.00	3.30	3.05	1.27	13.72	0.51	0.51	0.00	0.51	0.00
14	0.00	0.51	2.54	0.76	7.87	16.00	0.00	0.51	0.00	0.00
15	0.00	3.30	4.57	T	1.02	5.08	0.00	T	0.00	0.00
16	0.00	4.57	0.25	0.00	8.89	1.52	0.00	2.54	0.00	0.00
17	T	3.81	T	T	2.54	1.78	1.52	0.00	0.00	0.00
18	0.25	0.25	4.06	T	0.25	0.25	2.03	0.00	0.00	0.00
19	0.00	T	1.27	0.51	0.00	2.54	15.49	0.00	0.00	0.00
20	0.00	T	1.27	T	0.76	2.54	0.25	4.06	0.00	0.00
21	0.00	0.76	0.51	1.02	5.59	19.05	0.00	T	12.19	0.00
22	2.79	0.51	T	3.30	0.51	0.25	0.25	0.00	0.51	0.00
23	4.06	0.51	T	0.51	1.52	T	0.00	16.00	0.00	0.00
24	0.25	7.11	T	8.64	5.33	0.00	0.00	0.51	0.00	1.02
25	0.00	T	2.03	0.76	8.13	0.00	T	0.00	0.00	0.00
26	0.00	T	5.59	T	0.51	12.19	0.00	5.08	0.00	0.00
27	0.00	0.00	1.78	0.00	0.00	1.02	0.00	T	1.27	0.25
28	0.00	0.25	0.25	0.00	0.00	3.56	0.00	0.00	0.00	0.00
29	T	2.03	3.05	0.00	0.00	5.59	6.35	T	1.52	0.00
30	0.76	0.00	13.46	0.00		0.51	2.54	0.00	1.02	0.00
31	1.78		0.51	0.51		0.00	0.00	0.00		0.00
Total	23.11	70.87	87.38	25.15	65.02	82.04	60.20	53.59	52.07	1.27