Size of Jointed Goatgrass Seed Varies by Floret Position

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Introduction

- Jointed goatgrass is widely distributed across large areas of the semi-arid western USA. It thrives in a variety of soils and habitats.
- The dispersal unit of jointed goatgrass is a spikelet. Spikelets may contain one, two, or three seed.
- Many journals, bulletins, and presentations report that the secondary positioned seed within the spikelet is larger than seed from the primary floret. Data that support this claim have been difficult to obtain and not published in peer-reviewed form.
- Differences in seed size by floret position may lead to a contrast in survival and competitiveness of seedlings.
- The objective of this research was to quantify seed production and size by floret position for five jointed goatgrass populations grown in the field and at two nursery locations.

Materials and Methods

- Jointed goatgrass spikelets were collected during seed maturing in 2001 from fields of winter wheat, winter barley, and spring wheat in Oregon and Washington.
- Jointed goatgrass plants from these collections were grown together in a common garden nurseries at Moro and Pendleton, OR in the 2001-02 growing season. The climate at Moro is traditionally drier than Pendleton during the period of seed development. However, jointed goatgrass is well adapted to both locations.
- Seed production, length, width, and biomass were recorded by floret position for samples collected in 2001 and harvested in 2002.
- Seed were dissected from spikelets, adhered to graph paper, and scanned into Adobe Photoshop CS2 for measurements of length and width.
- Statistical procedures were performed using SAS. Confidence intervals were calculated using α=0.05.

Table 1 **Descriptions of crop history, nearest town, elevation, and location for the five jointed goatgrass populations collected in 2001.**

Population	History	Nearest Town	Elevation	Latitude	Longitude
Collection C-S	Spring wheat	Bickleton, WA	926	46.00	120.30
Collection G-W	Winter barley	Bickleton, WA	926	46.00	120.30
Collection F-W	Winter wheat	Helix, OR	320	45.99	118.73
Collection H-S	Spring wheat	The Dalles, OR	412	45.53	120.95
Collection J-W	Winter wheat	Wasco, OR	393	45.58	120.69

Seed & Structures

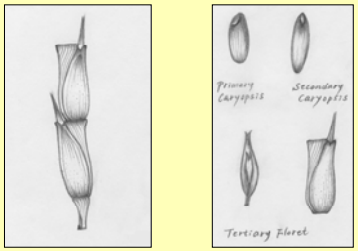

Figure 1 **Pencil sketches of two intact jointed goatgrass spikelets *(left)* and primary and secondary seed, tertiary floret, and spikelet *(right)*. Sketches courtesy of Sugae Wada, Oregon State University.**

Collection C-S

Figure 2 **Scans of seed from the primary floret *(left)*, secondary floret *(top right)*, and tertiary floret *(bottom right)*. Scans are scaled proportionately and are from the same sample of spikelets (*n*=25).**

Collection J-W

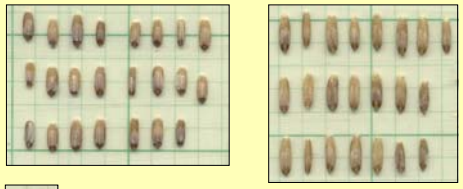

Figure 3 **Scans of seed from the primary floret *(top left)*, secondary floret *(right)*, and tertiary floret *(bottom left)*. Scans are scaled proportionately and are from the same sample of spikelets (*n*=25).**

Results & Discussion

- Over 3,800 spikelets were dissected and seed measured. Some seed were produced within all three florets for all populations.
- Overall, seed were found in 90% (CI 87-92%) of primary florets, in 79% (CI 76-82%) of secondary florets, and 11% (CI 6-16%) of tertiary florets.
- The average 1000-seed weight of primary seed was 8.42 g (CI 8.00-8.83 g), of secondary seed was 13.35 g (CI 12.46-14.23 g), and of tertiary seed was 11.90 g (CI 10.65-13.14 g).
- The average length of primary seed was 5.6 mm (CI 5.6-5.7 mm), of secondary seed was 7.0 mm (CI 6.9-7.1 mm), and of tertiary seed was 7.3 mm (CI 7.1-7.4). Seed width did not vary by floret position (average = 1.9 mm).
- Populations did not vary in the quantity of primary seed produced ($F_{6,52}$=1.97 p=0.0892). However, differences were found for seed produced in secondary and tertiary florets.
- The greatest overall seed production occurred in two populations that originated near Bickleton, WA. These populations formed more seed at secondary and tertiary floret positions compared to other populations. These seed were longer, and generally weighed less compared to seed from the same floret produced by other populations. Consequently, there is a seed size and number tradeoff in jointed goatgrass.

Table 2 **Summary statistics for seed production, 1000-seed mass, and seed length by jointed goatgrass population. Confidence intervals (α=0.05) are in parenthesis.**

	Production (%)			1000-Seed Mass (g)			Seed Length (mm)		
Population	Prim.	Sec.	Tert.	Prim.	Sec.	Tert.	Prim.	Sec.	Tert.
Collection C-S	93 (88-99)	89 (86-92)	26 (13-40)	6.7 (6.3-7.1)	10.2 (9.0-11.4)	11.3 (8.7-14.0)	5.5 (5.5-5.7	6.8 (6.7-7.0)	7.0 (6.8-7.2)
Collection G-W	94 (69-120)	96 (45-127)	68 (-8-2.2)	7.6 (0.2-15.2)	10.8 (10.4-11.3)	13.1 (9.1-17.3)	5.4 (5.3-5.6)	6.4 (6.3-6.7)	7.5 (7.3-7.7)
Collection FW	92 (86-96)	77 (72-80)	3 (0-6)	8.6 (8.3-9.0)	14.7 (13.7-14.7)	10.0 n/a	5.6 (5.5-5.7)	7.3 (7.2-7.5)	7.3 (5.4-9.3)
Collection H-S	74 (49-99)	60 (8-112)	3 (-3-8)	6.4 (4.3-8.7)	7.2 (4.8-9.6)	10.0 n/a	5.3 (5.2-5.5)	6.3 (6.0-6.6)	6.7 (4.2-9.2)
Collection J-W	88 (81-94)	79 (75-83)	4 (0-8)	10.4 (9.7-11.2)	16.9 (15.7-18.1)	14.4 (9.1-19.7)	6.3 (6.2-6.5)	8.2 (8.1-8.4)	8.5 (8.0-9.0)

Summary

- Variation in seed production and mass may lead to a greater likelihood of seedling establishment the following year.
- The secondary and larger seed in jointed goatgrass is known to have lower levels of seed dormancy (our previous research). Larger seed also lead to faster germination rates, greater plant heights, and greater aboveground biomass compared to smaller seed (Quinn et al. – see Program Number 37, WSWS 09).
- Future research should evaluate the effect of nutrient and water stress on seed development and fitness in the offspring.