

Response of Medusahead to Paraquat¹

JAMES A. YOUNG, RAYMOND A. EVANS, AND BURGESS L. KAY

Range Scientists, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Renewable Resource Center, Reno, Nevada; and Specialist, Department of Agronomy and Range Science, University of California, Davis, California.

Highlight

Medusahead plants from 23 sources were susceptible to paraquat at Davis, California, but resistant to applications of this herbicide at Reno or Stead, Nevada. Differences in response were not due to ecotypic variability among the sources.

Our purpose was to determine if ecotypic variability in medusahead (*Taeniatherum asperum* (Sim.) Nevski) was the cause of differential response of this species to 1,1'-dimethyl-4,4' bipyridinium ion (paraquat) application in different areas of western United States.

Recent studies have indicated that an application of paraquat is a valuable tool in reducing weed competition to permit the establishment of desirable forage species on rangelands (Evans et al., 1967). This technique has been particularly successful in controlling a number of annual species on the cismontane ranges of California (Kay, 1964, 1968; Kay and Owen, 1970). Paraquat gives excellent control of medusahead in California (Kay, 1964) but does not suppress it effectively at Reno, Nevada (Young et al., 1969). In eastern Oregon, also, paraquat failed to kill medusahead. In general, paraquat kills medusahead west of the mountains in California and Oregon, but has been ineffective east of the Cascades and Sierra Nevada.

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Other annual grasses are susceptible to paraquat on both sides of the mountains (Evans et al., 1967; Kay and Owen, 1970).

Significant ecotypic variability has been demonstrated among medusahead selections for a number of physiologic characteristics (McKell et al., 1962; Young et al., 1968 a, b; 1970). The demonstration of ecotypic variability suggested that the different responses to paraquat might be inherent.

Methods and Materials

In 1965, we obtained medusahead caryopses from 23 locations in Washington, Oregon, California, Idaho, and Nevada. At the collection sites, five of the sources were known to be susceptible to paraquat, four were known resistant, one had an intermediate response and the other 13 had not been tested for susceptibility to paraquat (Table 1).

The collection locations extend north to south over 700 miles and range in altitude from 50 to 5,170 ft. Mean annual precipitation at the sites ranged from 7 to 43 inches.

The locations are further described by Young et al. (1968 a, b), and are shown on a map by Young et al. (1970).

Caryopses of each selection were planted in three 6-ft rows in four replications of a randomized-block design. Two such gardens were established on October 1 in each of 3 years—1965, 1966, and 1967. The 1965 gardens were at Reno, Nevada. In the other years, the gardens were at Stead, 10 miles north of Reno. Except in 1965, in each successive year, the gardens were planted with the progenies of the previous gardens. In November, 1967 and 1968, gardens were planted at Davis, California. Caryopses

used for the three 1967–68 gardens at Davis were a portion of the original collections, and caryopses produced at Stead in 1967 by plants sprayed with paraquat and by unsprayed plants.

The 1968–69 Davis garden consisted of a composite planting of the caryopses of all 23 sources planted in a block.

In July of 1967, we established garden at Stead using caryopses produced at Stead in 1966 and in a separate garden; a portion of the original 1965 collections.

The Stead gardens were irrigated to induce germination. The garden established at Stead in the fall of 1967 did not germinate until the spring of 1968, because of early onset of cold temperatures.

The gardens were sprayed with paraquat at 0.5 lb./acre with the surfactant X-77² added at 0.1% per volume. The herbicide was applied with 35 gal/acre of water at 30 psi when the medusahead seedlings reached the two-leaf stage. At Reno-Stead, this varied from early March to mid-April for the October-planted gardens. For the 1967–68 garden at Davis and the summer-planted garden at Stead, the two-leaf stage was reached one month after germination. Portions of the 1968–69 planting at Davis were sprayed at 2-leaf stage, 3-leaf, and 12-leaf stage with 0.25, 0.38, and 0.5 lb./acre of paraquat, respectively.

The degree of susceptibility to paraquat was visually rated on a scale from 1 to 10, with 1 representing no apparent injury and 10 indicating death to all the plants.

Results and Discussion

All the sources of medusahead were resistant to paraquat when grown at Reno or Stead (Table 1). It made no difference whether the plants were grown from the original

²X-77 is a surfactant containing alkyl-aryl polyoxyethylene glycols, free fatty acids, and isopropanol. Mention of trade name does not constitute endorsement by U.S. Department of Agriculture.

Table 1. Reaction of 23 sources of medusahead to an application of paraquat at 0.5 lb./acre.^a

Source	Response to paraquat at point of origin ^b	Original seed		Grown at Reno		Parent sprayed with paraquat	
		Davis	Reno	Davis	Reno	Davis	Reno
Adin Airport, Calif.	-	9	1	8	1	8	2
Adin Mountain, Calif.	-	9	1	8	1	8	1
Canby, Calif.	-	8	2	9	1	8	1
Cindercone, Calif.	-	9	1	9	1	8	1
Gazelle, Calif.	I	9	3	9	1	9	2
Hopland, Calif.	S	8	1	9	1	8	1
Likely, Calif.	R	9	1	9	1	9	1
Potter Valley, Calif.	S	7	1	8	1	9	1
Red Bluff, Calif.	S	9	2	8	1	9	2
Vacaville, Calif.	S	9	1	9	2	9	1
Coyote Grade, Idaho	-	8	1	9	2	8	1
Gem #1, Emmett, Idaho	-	7	1	9	1	9	1
Gem #2, Emmett, Idaho	-	9	1	8	2	6	1
Reno, Nevada	R	9	1	9	1	9	1
Verdi, Nevada	R	9	1	9	1	9	1
Corvallis, Ore.	S	9	1	8	1	9	1
Douglas County, Ore.	-	8	1	9	1	9	1
Jackson County, Ore.	-	8	1	8	1	8	1
Ontario, Ore.	R	8	1	8	1	8	1
Richland, Ore.	R	9	2	8	1	8	1
Wheeler County, Ore.	-	8	1	8	1	9	1
Steptoe Butte, Wash.	-	9	1	9	1	7	1

^a Visually rated on a scale of 1 to 10 with 1 indicating no apparent effect on any plants and 10 indicating death of all plants.

^b Symbols: R = resistant; S = susceptible; I = intermediate reaction; - no information available.

collections of caryopses or from caryopses grown at Reno or Stead, or whether the parent plants of the caryopses had been sprayed with paraquat.

At Davis, in contrast, all the sources of medusahead were susceptible to paraquat in both years.

At Stead during the summer of 1967, the summer-grown plants sprayed with 0.5 lb./acre of paraquat showed more leaf burn than did winter grown plants, though they largely survived the treatment. These plants over-wintered and were resprayed the next spring without apparent injury. The 1967 common garden at Stead, which did not germinate until the spring of 1968, also survived the paraquat treatment.

Resistance or susceptibility to paraquat at the original collection site showed no apparent relation to response at Reno-Stead or Davis.

There is no evidence that the differences in response to paraquat at the different locations involved ecotypic variability among the various sources. However, a few of the sources were completely killed by the paraquat treatment at Davis. A few plants in many sources retained some green color for a prolonged period. Use of a reduced rate of paraquat might accentuate variability among the sources at Davis, but it would be of little practical significance.

The differences in susceptibility between the *cis*- and *transmontane* populations is apparently due to differences in unidentified characteristics of the two environments.

Gazelle, California, approximates a mid-point in environmental conditions between *cis*- and *transmontane* California. It is located in a mountain valley at a moderate elevation. At Gazelle, the medusa-

head population is intermediate in susceptibility to paraquat, but the source from Gazelle is resistant at Reno and susceptible at Davis.

The remarkable point about the variable susceptibility of medusahead to paraquat is that this herbicide has largely contact action with minimal translocation. If paraquat were dependent on translocation in order for it to be phytotoxic, there would be many more chances for environmental interactions.

The practical significance to range managers in the Intermountain area is that they do not have a herbicide for simultaneous spraying and reseeding of medusahead infestations.

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