

# Field Emergence and Seedling Growth of Lettuce as Affected by Pre-plant/Pre-emergent Herbicides.

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## **Abstract**

*Pre-plant and pre-emergence herbicides are commonly used in lettuce production. We investigated possible effects the herbicides benefin (Balan), pronamide (Kerb) and bensulfide (Prefar) had on emergence and seedling growth of several iceberg lettuce varieties that had been primed and pelleted by seed enhancement companies. The herbicide Prefar and a mixture of Balan+Prefar had the greatest impact on dry weight regardless of variety, while seedlings grown on Kerby plots were not significantly different than seedlings from untreated plots. Dry weight accumulation and field emergence were influenced significantly by pellet types and priming methods.*

## **Introduction**

The use of pre-plant and pre-emergence herbicides such as Balan (benefin), Kerb (pronamide) and Prefar (bensulfide) is common with lettuce. Normally, little injury occurs in lettuce from these herbicides when labeled rates are used and growth conditions are favorable. These herbicides act to disrupt mitosis, and can potentially act as an additional stress during germination and seedling establishment. Herbicide damage may be identified by stunted plant growth and a reduction in root area. Seed quality, or vigor, may also affect the sensitivity of the seedling to herbicides. Virtually all lettuce seed is pelleted, and certain varieties are primed to alleviate thermodormancy and skotodormancy. Seed enhancement procedures such as pelleting and priming stress the seed resulting in a reduction in the shelf life of the enhanced seed compared to untreated seed. We conducted field studies to assess the effects pre-emergence/preplant herbicides, priming, pelleting, and variety had on germination and stand establishment of lettuce planted in the Empire (early September) time slot in the desert.

## **Materials and Methods**

Five seed varieties commonly planted in the desert in early September were obtained: Desert Queen, Marvel, and Seeker from Genecorp, Diplomat from Seminis Vegetable Seeds, and Fall Green from Ferry Morse. Ten pounds of each variety from the same lot were divided into approximately 1 pound samples and sent to seed technology companies (Incotec, I.S.T., Seed Dynamics, Seed Systems) to be pelleted, or primed and pelleted. Data for the seed pellet and priming treatments are coded so as not to endorse one proprietary product over another. Each seed technology company received 10 1-pound bags and no further physical separation was performed on the seed. The seed was planted in September 1996 in three field locations: Yuma Agricultural Center farm, Moor Ranch, and the Meyer fields. Herbicides were sprayed preplant at labeled rates (ai/acre: Kerb 2.0 lb; Balan 1.5 lb, Prefar 6.0 qt; Balan 1.5 lb + Kerb 2.0 lb; Balan 1.5 lb + Prefar 6.0 qt; Prefar 6.0 qt + Kerb 2.0 lb). The seed were planted in commercial fields on 14 September, 18 September, and 20 September, at the Moore Ranch, YAC, and Meyer fields, respectively. Emergence data were taken 9 or 10 days after planting. For each treatment, the total number of seeds within one meter which had emerged with two intact cotyledons were scored as having germinated. Data are expressed as a percentage of the

highest number of germinated seeds for that treatment. Dry weight data were taken from 8 plants from each treatment with four replications 11 DAP on the Moore Ranch and 26 DAP at YAC.

## Results and Discussions

At both the YAC and Moore Ranch, dry weight was affected by the type of herbicide used (Fig. 1). At the YAC, untreated check and Kerb plots had the highest dry weight, while Prefar and Balan+Prefar plots had plants with the lowest dry weight (Fig. 1). Plants harvested 11 DAP from the Moore Ranch were smaller if grown on Balan+Prefar plots than if grown on Balan plots (9.9 mg/plant vs. 10.8 mg/plant, respectively). These data represent an average of all pellets, all varieties, and both treatments (primed or non-primed).

Varietal differences were seen at both the YAC Farm and the Moore Ranch. This may be an indication of varietal vigor, or it may be a reflection of the production techniques for those particular lots. The variety Fall Green was about 8% larger than Desert Queen 26 DAP on the YAC farm (data not shown). On the Moore Ranch, the variety Marvel had the highest dry weight while Diplomat had the lowest (Fig. 2). A three-way interaction occurred between herbicide, variety and seed treatment (primed or non-primed) in the experiment conducted at the YAC (data not presented).

Primed lettuce seed (average of all varieties and pellets) had higher dry weight than did non-primed seed 11 DAP on the Moore Ranch (10.7 mg/plant and 10.0 mg/plant, respectively, data not presented). Seed pelleted, or primed and pelleted, by company D had higher dry weight 11 DAP on the Moore Ranch, while seed from A and B had the lowest dry weight (Fig. 3). If all seed pellet and priming treatments were the same, we would have expected no differences in dry weight because the seed enhancement companies were using the same seed lots for each variety.

On the Moore Ranch, there were no significant interactions between seed pellet and herbicides, seed pellet and seed treatment (non-primed or primed), seed pellet and variety, and a three-way interaction between seed pellet, variety and treatment (data not shown). The dry weight of seedlings derived from company D was greater than all other pellets, and there were no differences in dry weight between A and B seed (data not presented). There was no difference detected in seedling dry weight due to herbicide for companies A, B, and C, but seedlings derived from company D had greater growth in Balan plots versus Balan + Prefar plots (data not presented). Generally, seedlings from primed seed initially had greater dry weight than did non-primed seeds but by 26 DAP the differences were not significant (data not presented).

There was no difference in germination between not-primed and primed seed 4 DAP on the Moore Ranch, but by 9 DAP germination of not-primed seed was 3.3% greater than primed seed. Germination of not-primed seed was 9% higher than primed seed on the Meyer field. No differences in germination between not-primed and primed seed were detected on the YAC farm. Herbicides had an initial slowing effect on germination on the Moore Ranch as Balan plots had 5.4% higher germination than did Balan + Prefar plots 4 DAP. However, by 9 DAP there were no significant differences as germination increased by 5.3% on Balan plots and 10% on Balan + Prefar plots. No herbicides effects on germination were detected on the YAC farm or the Meyer fields.

There were consistent differences observed due to seed pellet. Germination was highest in seeds derived from company D at all three test locations (Fig. 4 A, B, C). However, there were no statistical differences between A and C on the Moore Ranch and Meyer fields (Figs. 4 A, B, C). Varietal differences in germination were observed, but the differences between varieties was not as consistent as pelleting treatment differences. Diplomat had the highest field emergence at both locations, while Seeker had the lowest germination (Figs. 5 A, B). Of the two varieties planted at the YAC farm, germination of Fall Green was higher than Desert Queen (100%, 82.4%, respectively).

## Acknowledgment

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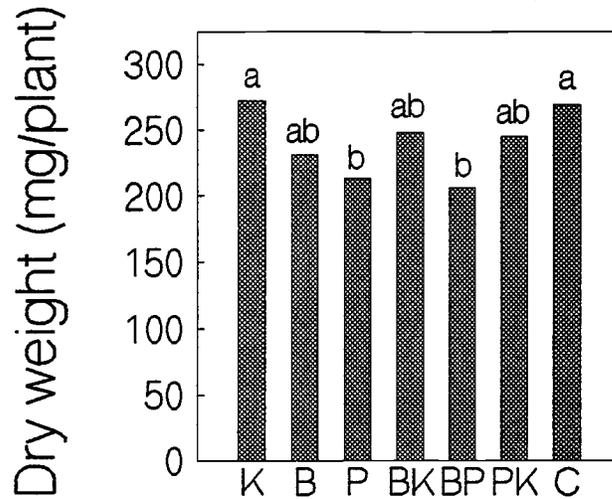


Figure 1. Effect of herbicides (Kerb -K; Balan -B; Prefar -P; Balan+Kerb - BK; Balan+Prefar - BP; Prefar+Kerb -PK; Untreated check - C) on the dry weight of lettuce. Data are averages of varieties (Desert Queen and Fall Green), seed treatment (primed and non-primed), and pelleting (Incotec, I.S.T., Seed Dynamics, and Seed Systems). Plants were grown on the Yuma Agricultural Center farm and harvested 26 days after planting. Herbicide treatments identified by the same letter are not significantly different as determined by LSD,  $P < 0.05$ .

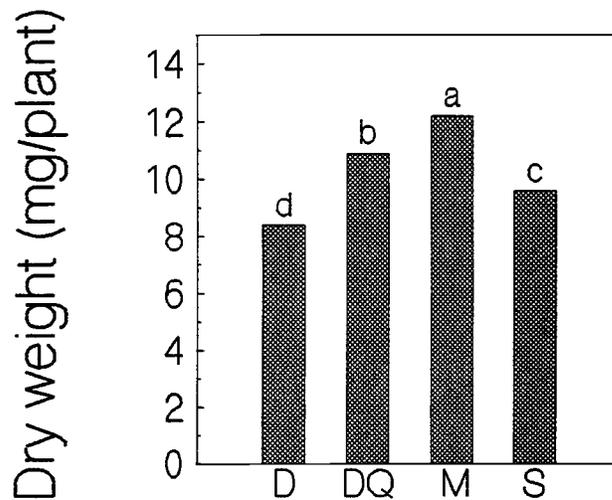


Figure 2. Dry weight of lettuce varieties Diplomat (D), Desert Queen (DQ), Marvel (M), and Seeker (S) grown on the Moore Ranch and harvested 11 days after planting. Data are averaged across seed treatment and pellets. Varieties identified by the same lower case letter are not significantly different as determined by LSD,  $P < 0.05$ .

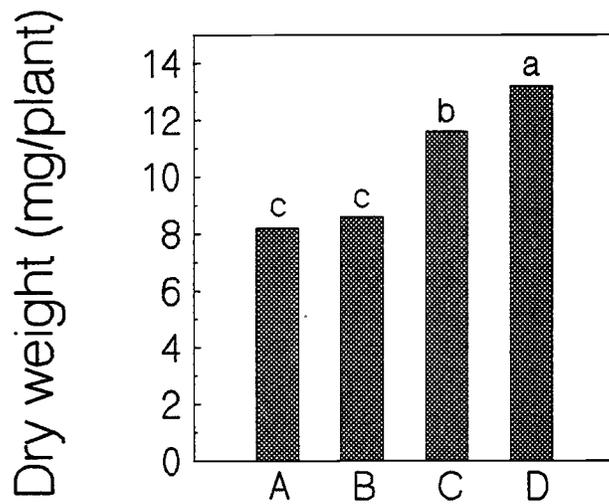


Figure 3. Dry weight as a function of seed pellet. Data are averages of both seed treatments (primed or non-primed), and variety (Desert Queen, Diplomat, Marvel, Seeker) and were harvested from the Moore Ranch 11 days after planting. Pellets identified by the same lower case letter are not significantly different as determined by LSD,  $P < 0.05$ .

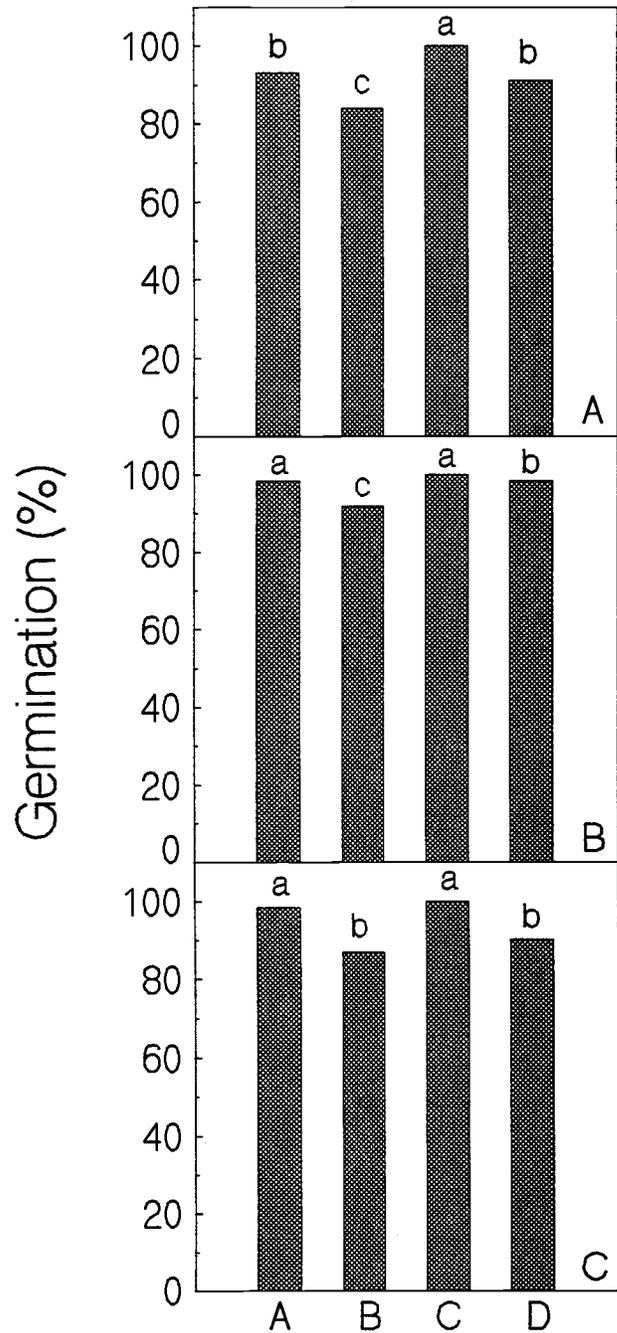


Figure 4. Field emergence of lettuce varieties 9 days after planting on the Yuma Agricultural farm (A), Moore Ranch (B) and Meyer Fields (C) as a function of seed pellet. Varieties on the Yuma Agricultural Center included Diplomat and Fall Green. The Moore Ranch and Meyer Fields included the varieties Desert Queen, Diplomat, Marvel, and Seeker. Pellets identified with the same lower case letter are not significantly different as determined by LSD,  $P < 0.05$ .

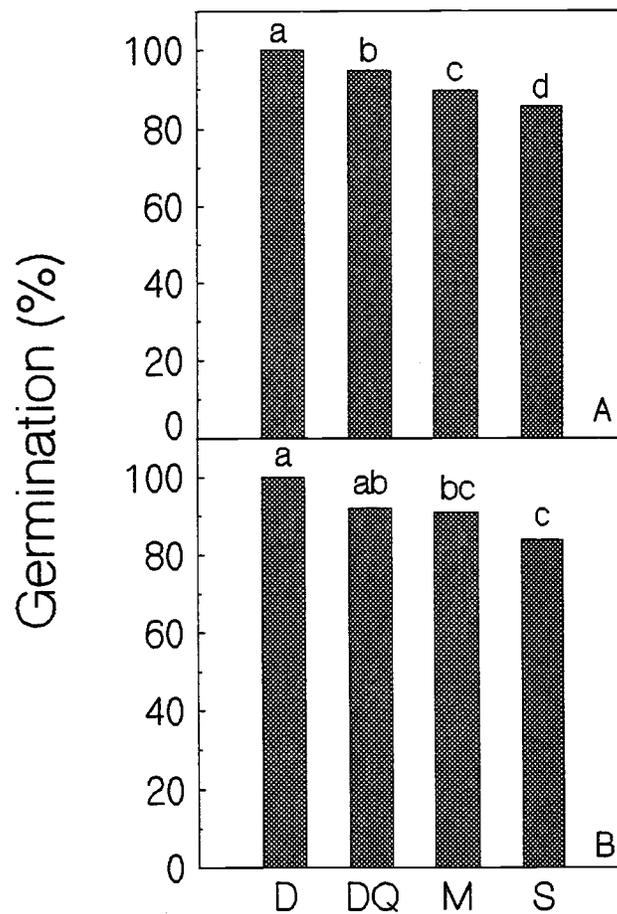


Figure 5. Field emergence of the lettuce (varieties Diplomat, D; Desert Queen, DQ; Marvel, M; and Seeker, S) planted on the Moore Ranch (A) or the Meyer fields (B). Varieties identified by the same letter are not significantly different as determined by LSD,  $P < 0.05$ .