



Organic Weed Management Strategies in Dry Edible Beans



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Introduction

- Michigan is the #1 producer of organic dry edible beans in the U.S., accounting for 37% of the acreage and 47% of the sales
- Michigan organic dry bean growers have expressed the need for information on weed management in this niche system
- Comparisons among weed management tactics will increase the efficiency of organic dry bean production

Objectives

- Evaluate the use of a propane flamer and rotary hoe alone and in combination for early-season weed management
- Determine optimal timing of rotary hoeing using growing degree days (GDD) for weed control

Materials & Methods

Objective 1- Combinations of Flaming and Rotary Hoeing

- Location: Kellogg Biological Station (Hickory Corners, MI)
- Edible black bean variety: 'Jaguar'
- Early season weed control treatments (up to V2 stage)

Timing*	Treatment				
	1	2	3	4	5
Preemergence	Flame	Flame	Flame	Rotary Hoe	-
VC	-	Flame	Rotary Hoe	Rotary Hoe	-
VC-V1	-	-	Rotary Hoe	Rotary Hoe	-
V2	Cultivate	Cultivate	Cultivate	Cultivate	Cultivate

*Timings are based on dry bean stage of development
 -Signifies no management at that stage of development

- From the V2 stage onward, beans were cultivated as necessary until canopy closure
- Weed densities were recorded after each weed control measure
- Yield and dry bean population data were recorded at harvest
- Data were analyzed using SAS PROC MIXED ($P \leq 0.05$)

Objective 2- Rotary Hoe (RH) Timing

- Location: MSU Agronomy Farm (East Lansing, MI)
- Edible black bean variety: 'Jaguar'
- Early season weed control treatments (up to V2 stage)
 - RH every 7 days
 - RH every 125 GDD (Base 38F)
 - RH every 250 GDD (Base 38F)
 - Weed free (managed with preemergence herbicides)
 - Cultivation only (no early-season control)
- From the V2 stage onward, beans were cultivated as necessary until canopy closure
- Weed densities and bean populations were recorded twice
 - One week after RH treatments were complete
 - One month after cultivation was complete
- Yields were recorded at harvest
- Data were analyzed using SAS PROC MIXED ($P \leq 0.05$)

Results

Objective 1- Flame and/or Rotary Hoe

- In both years, the Flame + Rotary Hoe (2x) and the Rotary Hoe (3x) treatments resulted in the fewest weeds (Fig. 2) and the highest yields (Fig. 3)
- Dry bean populations were lowest in the Flame (2x) treatment, reducing the population by 46% and yield by 54% compared with the other treatments



Figure 1. Propane flamer used in Objective 1 (left) and rotary hoe used in Objective 2 (right).

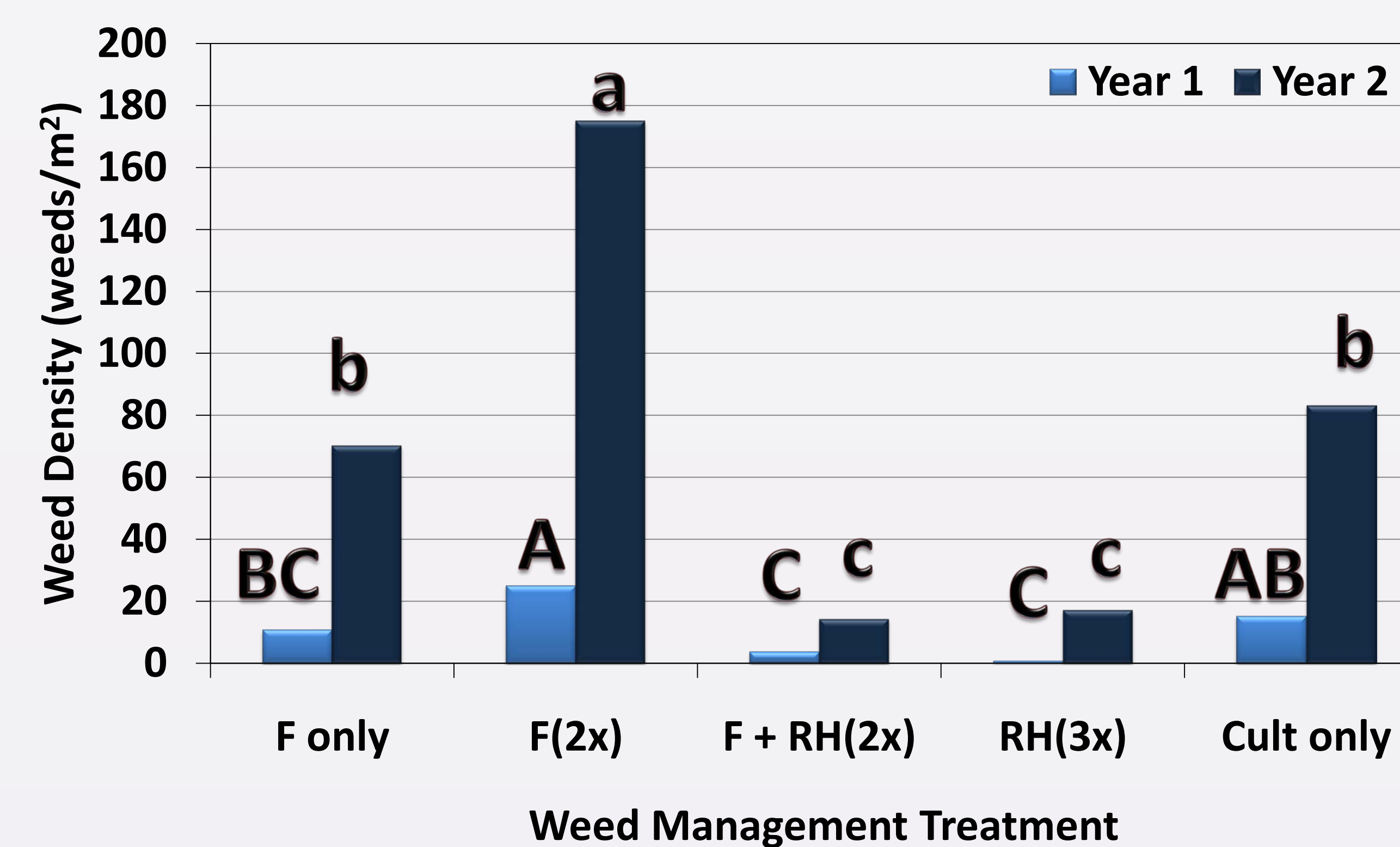


Figure 2. Weed densities for combinations of flaming (F) and rotary hoeing (RH) one month after all cultivations. Years were analyzed separately due to a treatment-by-year interaction.

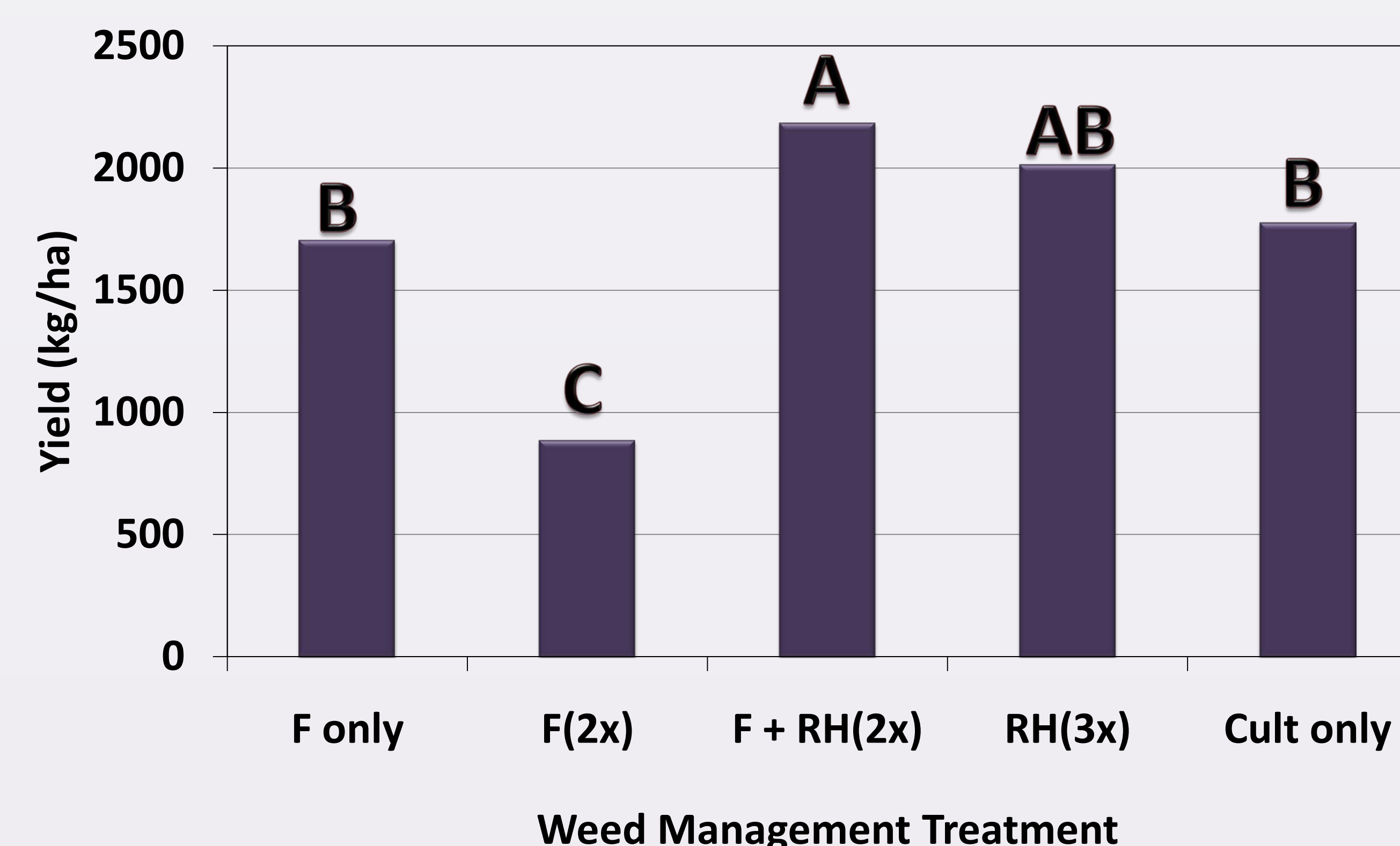


Figure 3. Dry bean yield as affected by combinations of flaming (F) and rotary hoeing (RH), combined over years.

Objective 2- Rotary Hoe Timing

- The 250 GDD, 7 day, and 125 GDD timings resulted in two, three, and four passes with the rotary hoe, respectively
- More frequent rotary hoeing reduced dry bean populations in year 2 (data not shown)
- Weed density did not differ among the 7 day, 125 GDD, 250 GDD treatments (Fig. 4)
- Weed density in the 125 GDD treatment did not differ from the weed-free treatment (Fig. 4)
- In both years there was no yield difference among the RH treatments (Fig. 5)
- In year 2 there was no yield difference between the 250 GDD and the weed free treatment (Fig. 5)
- Yield loss in the cultivated only treatment was likely exacerbated in year 1 due to drought conditions during the time of pod fill in August (data not shown)

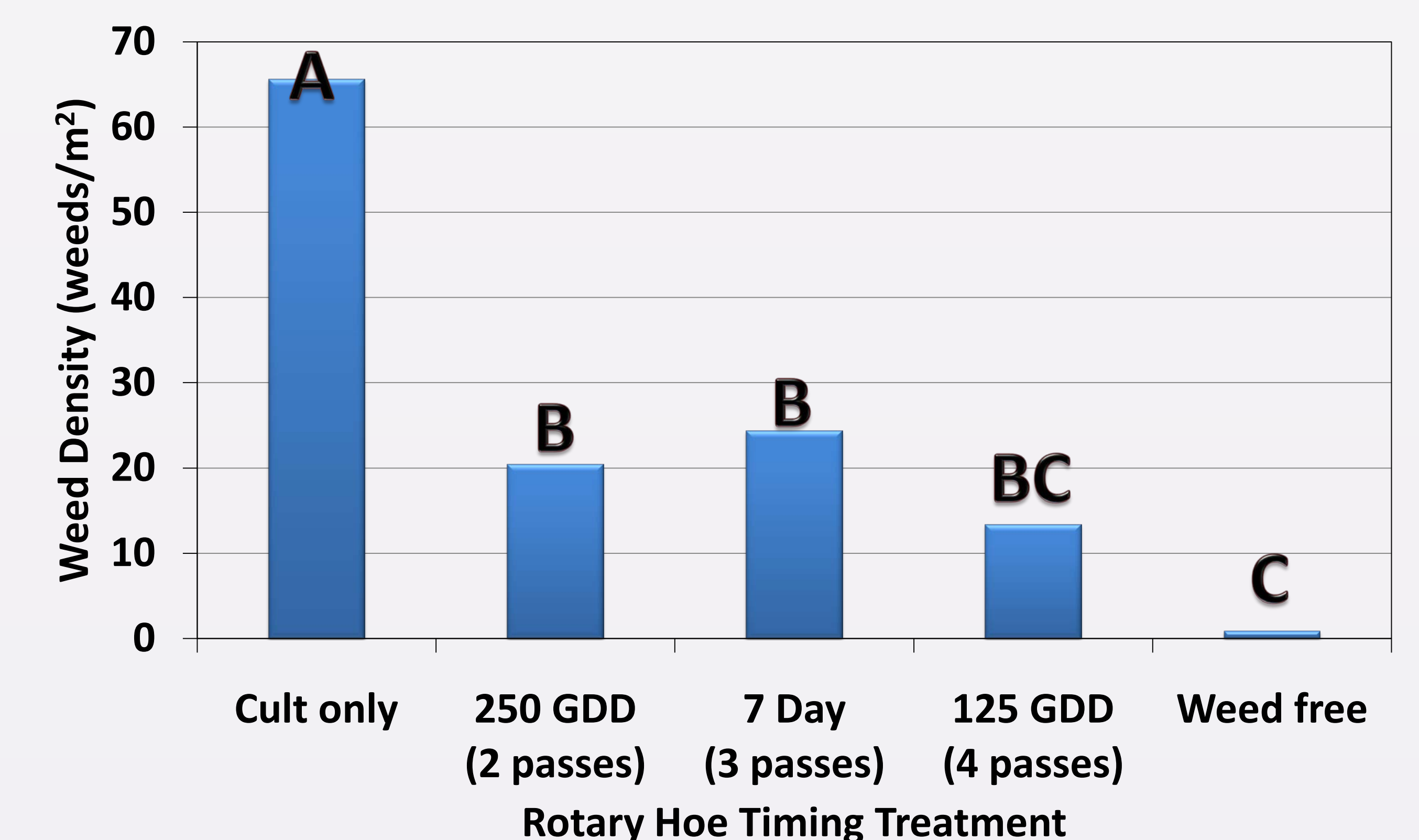


Figure 4. Weed densities for the rotary hoe timing treatments one month after cultivation was complete, combined over years.

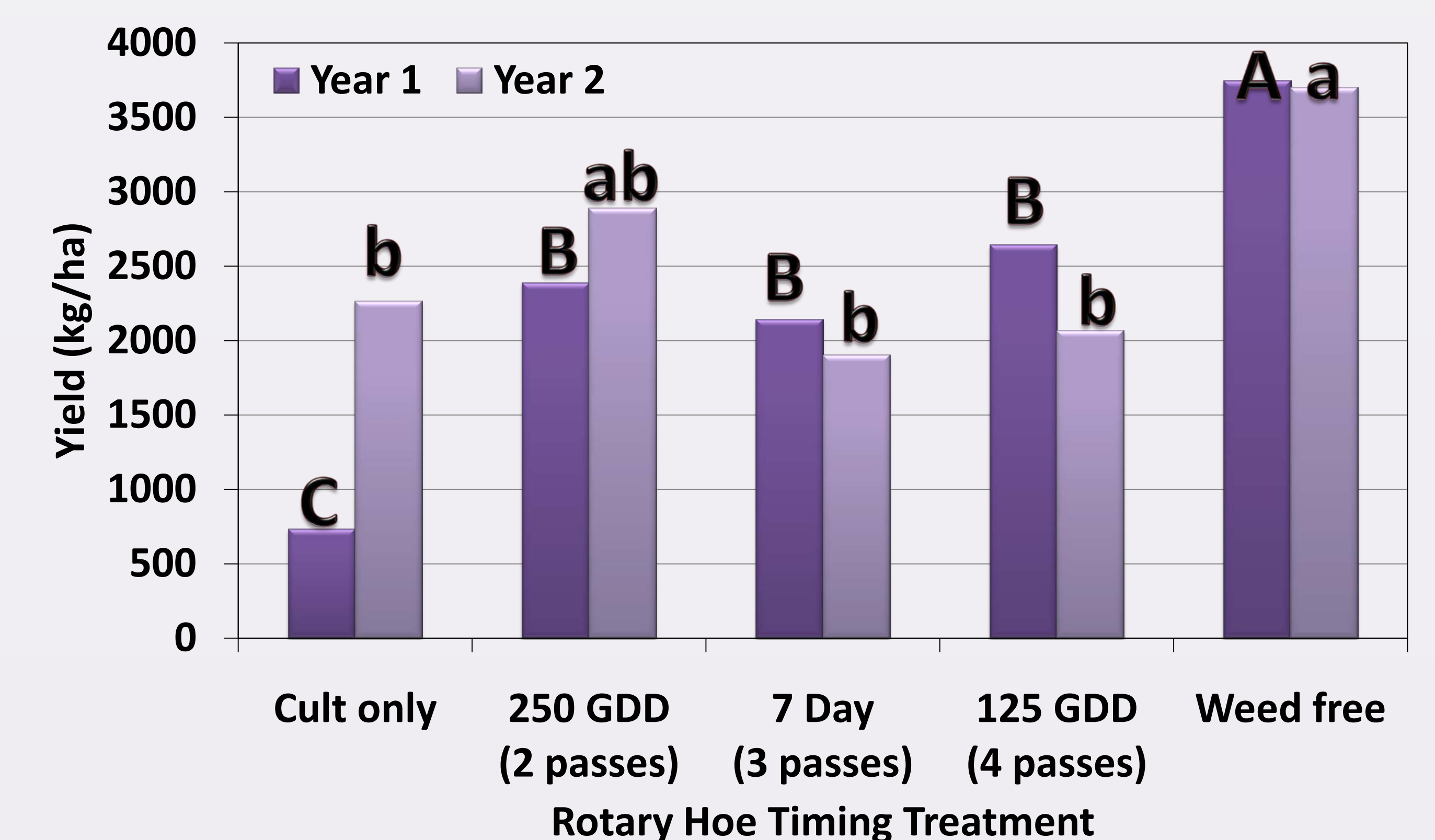


Figure 5. Dry bean yield as affected by rotary hoe timing treatments. Years were analyzed separately due to a treatment-by-year interaction.

Conclusions

Flaming controls weeds in dry beans when done prior to bean emergence and in combination with rotary hoeing; however, flaming may not be as economical as using the rotary hoe alone. Rotary hoeing every 250 GDD early in the season resulted in weed control similar to more frequent rotary hoeing. Dry bean yield in the 250 GDD treatment was similar to the weed free treatment in one of two years.

Acknowledgements



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