

INTRODUCTION

- Kentucky bluegrass (*Poa pratensis* L.) (KB), a cool-season turfgrass species significantly used in lawns, sports fields, and parks due to its rhizomatous growth habit, but has slow germinating characteristics (14-30 days) from seeds (Christians, 2011; Huff, 2003).
- Slow germination allows weed encroachment, disease and pest attack, purchase of more seeds, increased establishment management inputs like fertilizer, irrigation and mowing.
- Seed companies have classified KB seeds into 3 aggressive classifications types but its influence on establishment speed are not unknown (Brilman, 2018).
- Germination percentage are stated on seed labels, but rate of seed germination of all seeds are not known.
- There is therefore a need to understand germination rates of commercially available Kentucky bluegrass seeds and their establishment speeds to reduce cost.

OBJECTIVE

Evaluate influence of germination rate of aggressive classification types (i.e. High, medium, and low) on establishment speed.

MATERIALS AND METHOD

GROWTH CHAMBER STUDY:

- 20 Kentucky bluegrass cultivars were placed in petri dishes, replicated and incubated in a growth chamber for 28 days.
- Petri dishes were randomized daily, and seeds moistened with 0.2% KNO₃ to encourage dormancy.
- Kentucky bluegrass seeds with visible signs of radicle (primary root) and coleoptile (first shoot) were counted as germinated seed and discarded.
- Total and cumulative germination counts were fitted to a four-parameter sigmoidal regression model in GraphPad and the regression curve gave IC50, IC70, and IC90 (days until 50, 70 and 90% germination).
- Growth chamber experiment was conducted in 2022 (Run 1), 2023 (Run 2), and 2024 (Run3) to confirm results.

FIELD STUDY:

- Plots were seeded (2 pure live seed cm⁻²) at Rocky Ford Turfgrass Research Center, Manhattan Kansas, on 9th Sept. 2022 (Run 1), repeated in 2023 (Run 2).
- Field plots were fertilized with slow-release nitrogen fertilizer (43-0-0; SGN:150, polymer-coated-sulfur-coated urea) at 3.5 lb N 1000 ft² yr⁻¹ in three split applications, mowed at 3.25 inches and irrigated 1.0-inch wk⁻¹ weekly.
- Establishment speed differences were measured weekly with digital image analysis (1-100% vegetation cover) from 2-10 Weeks After Planting (WAP) and in 32, 36 and 39 WAP.
- Turf analyzer and SAS V 9.4 (SAS Institute Inc.) were used to analyze results, utilizing the GLIMMIX procedure and means separated with Fisher's LSD test ($\alpha = .05$).

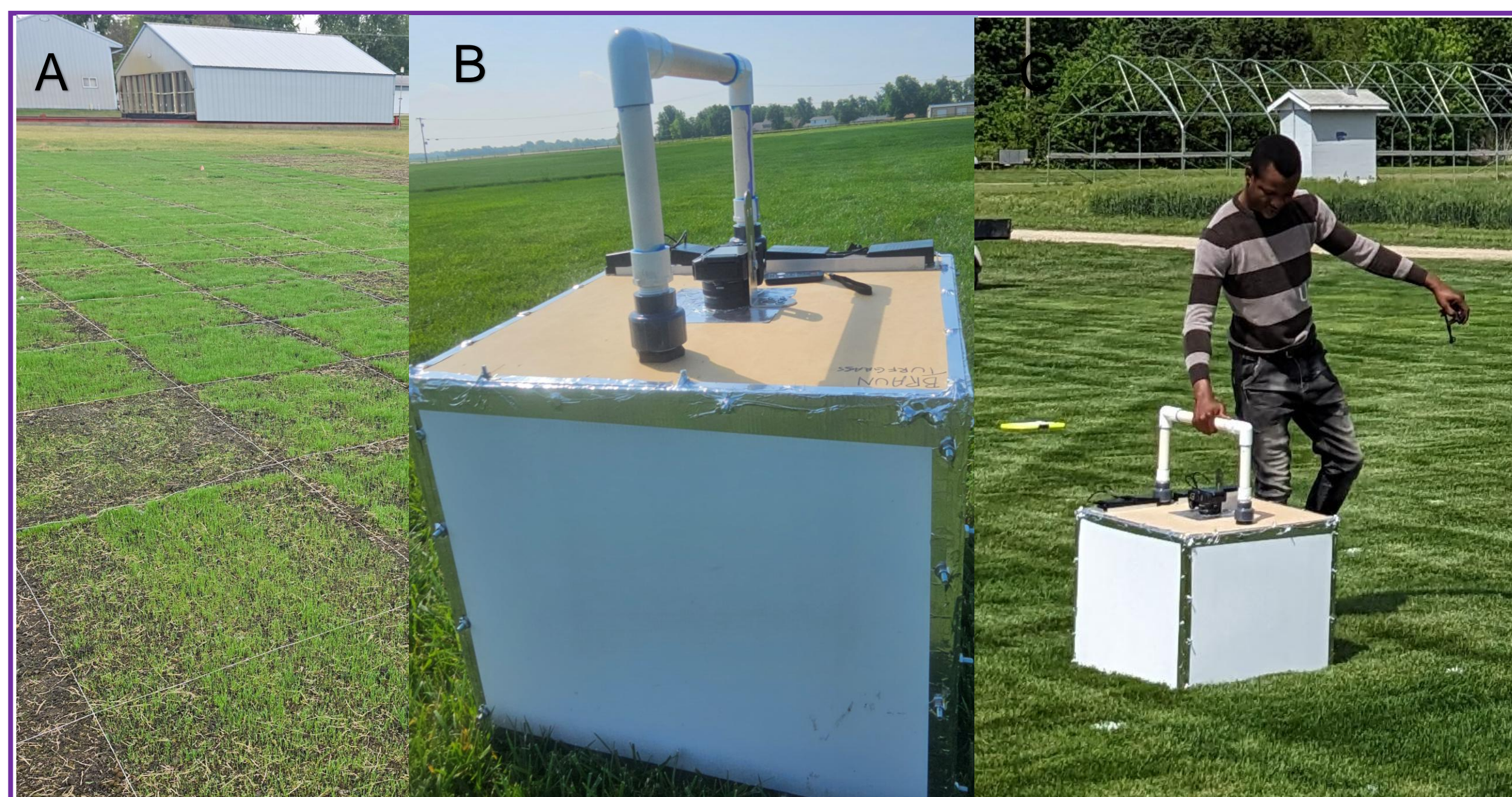


Figure 2: (A) Study area at 1 MAP; (B) Light box attached with Nikon Z30 camera and four power pack; (C) Measuring establishment speed at 9 MAP using digital image

RESULT

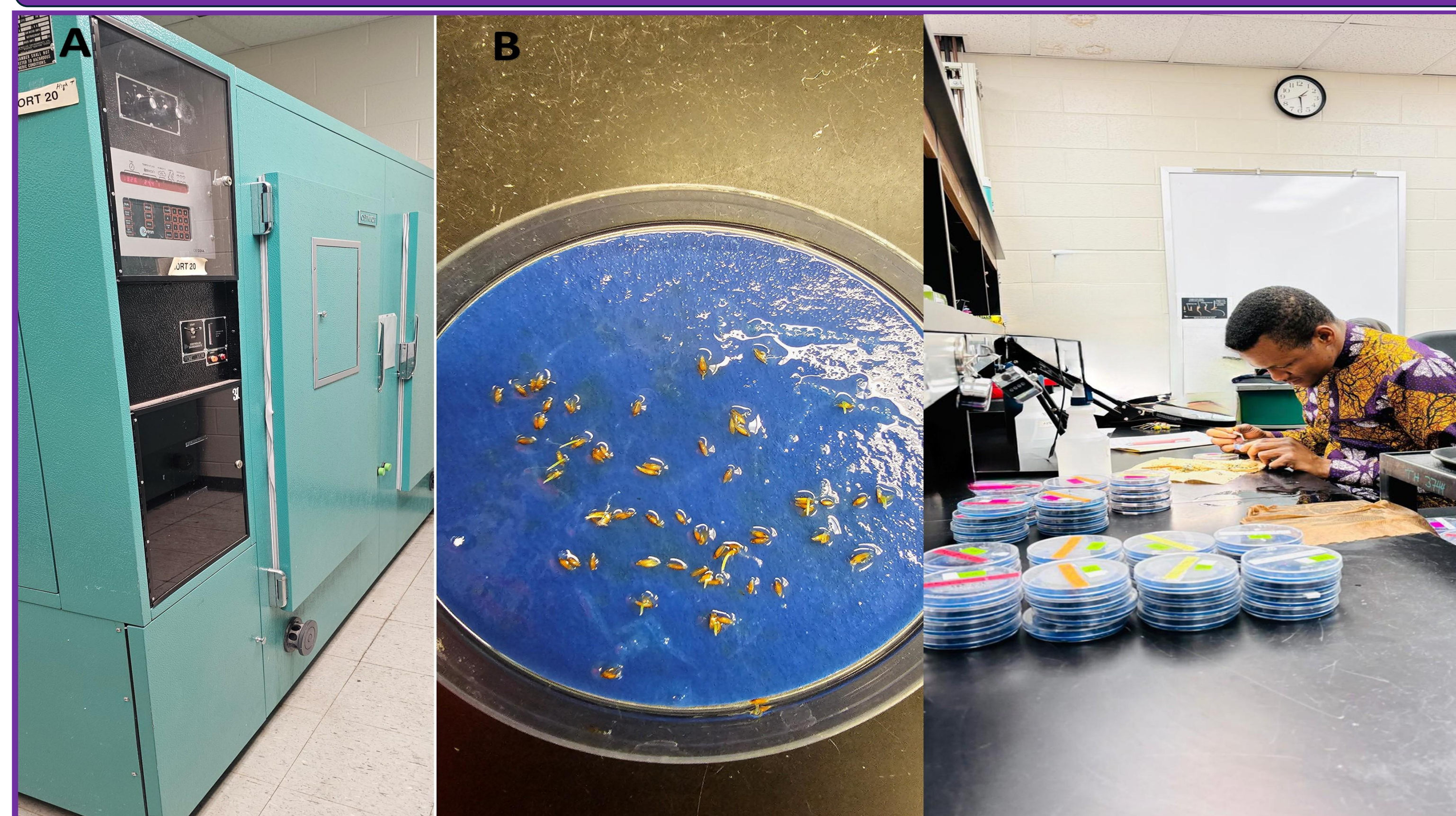


Figure 2: (A) Growth chamber (seed incubator); (B) Germinated seeds with visible radicle and coleoptile in a petri dish; (C) Counting germinated seeds and applying 0.2% KNO₃ daily to keep seeds moist and encourage dormancy.

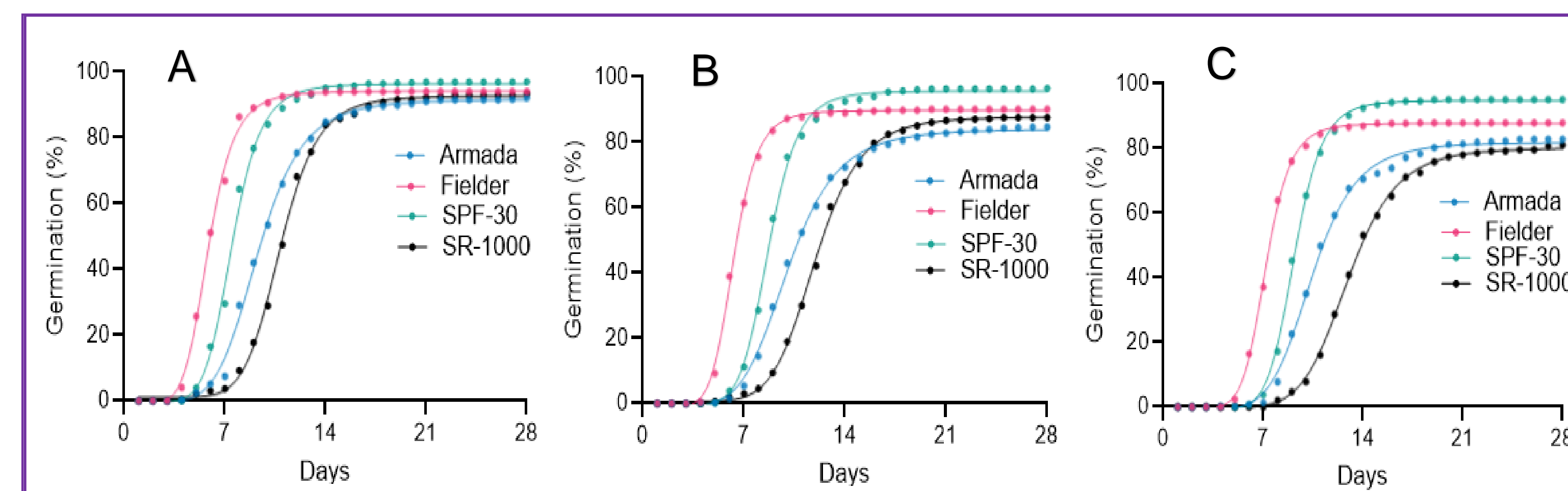


Figure 3: Sigmoidal regression curves from GraphPad prism showing IC50 output (days to 50% germination); first curve showing a steep slope indicates less days to reach 50% germination (e.g. Fielder); (A) Run 1; (B) Run 2, and (C) Run 3.

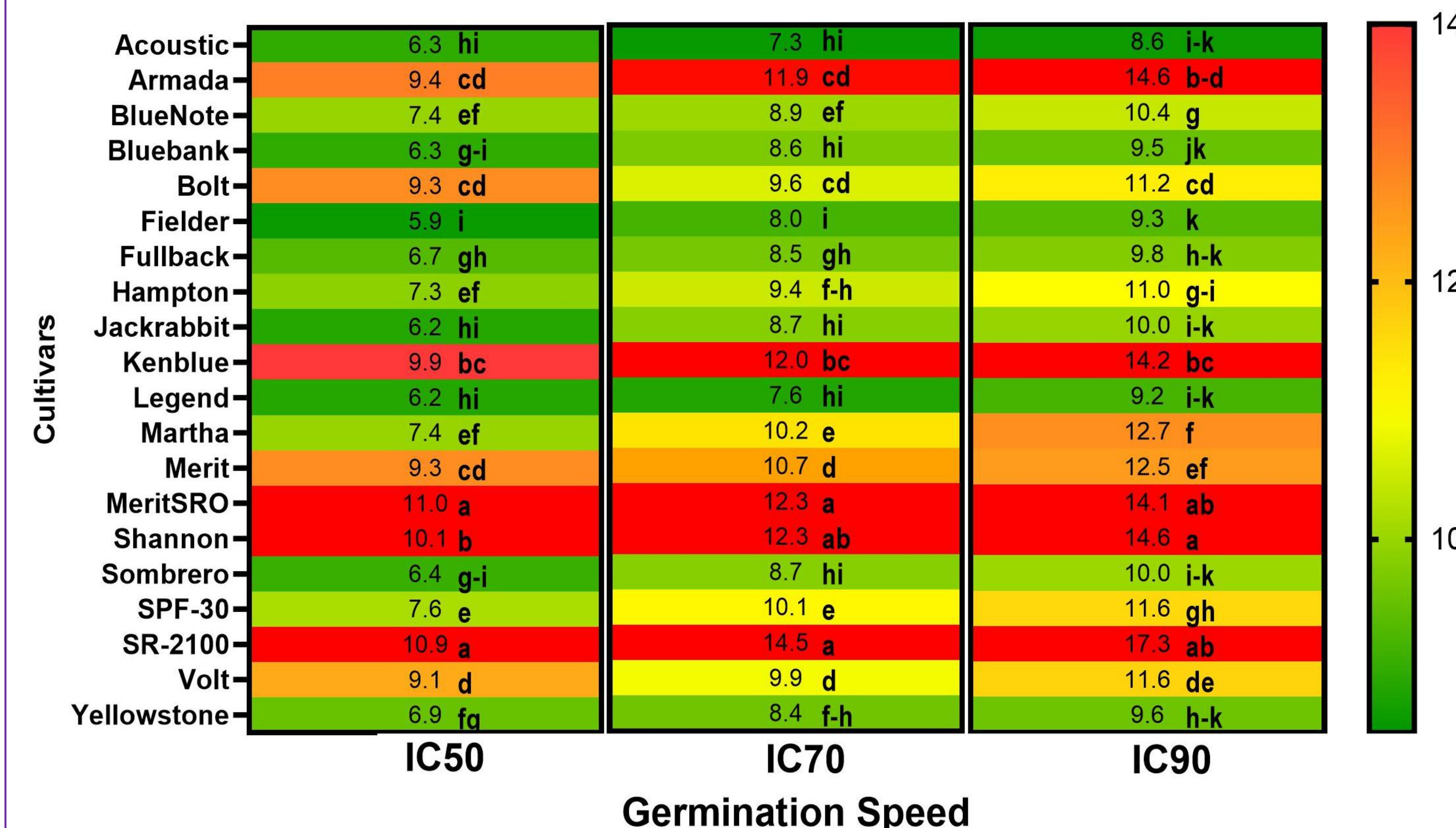


Figure 4: Four-parameter Sigmoidal Regression model from GraphPad Prism output showing germination speed at IC50, IC70 and IC90; Lower number indicate less days to reach 50, 70 AND 90% germination respectively; Means within treatments (germination speed) with a common letter are not significantly different according to Fisher's LSD test ($\alpha = .05$).

Cultivars	Agg types	2023			2024		
		1 MAP	2 MAP	32 MAP	1 MAP	2 MAP	32 MAP
Acoustic	High	58.3 d-f	94.8	94.2 f	60.9 c-e	94.7 c-e	94.2 f
Armada	Low	57.1 ef	98.1	99.1 a	65.3 b-d	97.8 ab	99.0 a
BlueNote	High	66.2 b-d	96.6	98.1 a-c	66.9 a-c	94.5 e	98.1 a-c
Bluebank	Medium	59.1 c-f	94.9	96.0 e	60.8 c-e	94.6 de	96.0 e
Bolt	Medium	69.1 ab	99.3	98.9 a	66.4 a-d	98.3 a	99.0 a
Fielder	Medium	68.2 ab	95.1	98.7 ab	71.1 ab	97.2 ab	98.7 ab
Fullback	Medium	62.8 b-e	98.7	99.0 a	66.1 a-d	98.9 a	99.0 a
Hampton	High	69.2 ab	97.4	96.8 de	63.1 b-e	96.8 a-d	96.8 de
Jackrabbit	Medium	68.1 a-c	96.9	98.2 a-c	75.6 a	98.4 a	98.2 a-c
Kenblue	Low	58.6 d-f	99.0	98.5 a-c	55.4 e	96.9 a-c	98.5 a-c
Legend	Medium	63 b-e	95.6	93.6 f	58.7 c-e	95.6 b-e	93.6 f
Martha	High	54.2 ef	96.7	99.0 a	61.2 c-e	98.4 a	99.0 a
Merit	Low	69.4 ab	97.9	97.6 a-c	65.6 b-d	97.3 ab	97.6 b-d
MeritSRO	Low	69.4 ab	96.3	96.7 de	57.0 de	97.0 ab	96.7 de
Shannon	Low	58.5 d-f	96.9	98.8 a	62.6 b-e	95.7 b-e	98.8 a
Sombrero	High	76.9 a	99.3	98.5 ab	58.9 c-e	98.3 a	98.5 ab
SPF-30	High	69.5 ab	98.0	98.8 a	71.5 ab	97.8 ab	98.8 a
SR-1000	High	50.7 f	96.4	97.4 cd	57.2 c-e	95.6 b-e	97.4 cd
Volt	Low	68.6 ab	98.3	98.9 a	61.2 c-e	93.9 e	99.0 a
Yellowstone	Low	59.0 d-f	97.1	98.8 a	60.7 c-e	97.5 ab	98.8 a

P-value: Treatment <.0001 0.2638 <.0001 0.0063 <.0001 <.0001

Table 1: Establishment speed differences (1-100% vegetation cover) for run1 (2023) and run 2 (2024); Means within treatments (germination speed) with a common letter are not significantly different according to Fisher's LSD test ($\alpha = .05$).

Linear Regression for IC/D50

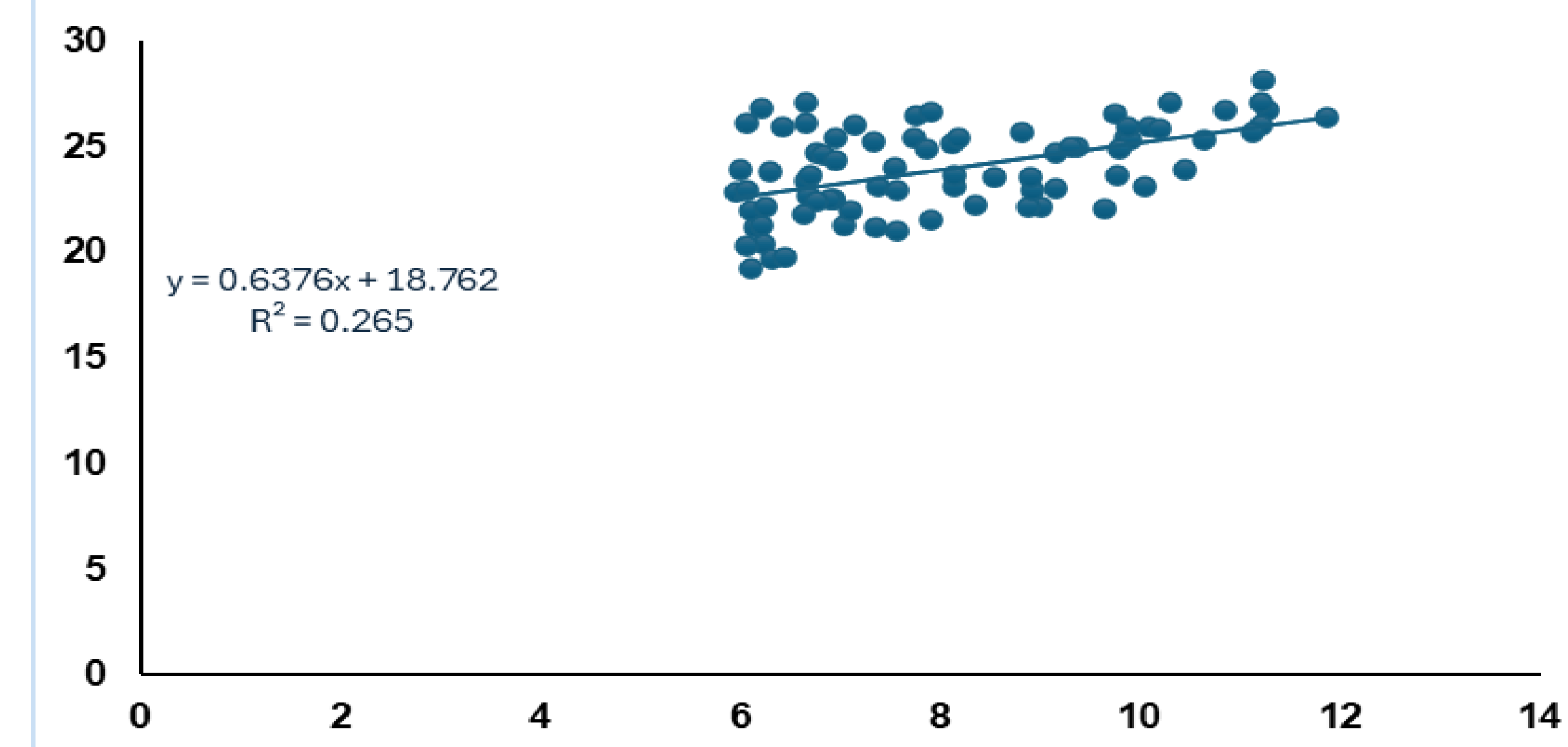


Figure 5: A Linear regression curve showing a weak positive relationship between germination speed (IC50) and establishment speed after 50 days of seeding (D50).

SUMMARY

- Some Kentucky bluegrass cultivars had fast germination speed i.e less days to reach 50 % germination (IC50) in a range of 5 to 8 days while slow germinating cultivars require 10 – 13 days (Fig. 4).
- However, most KB cultivars that reached 50% germination with less days, were also consistent at 70% and 90% within 10 days when compared to 17 days for slow germinating cultivars (Fig 4).
- Across three experimental runs, cultivars with slow germination rate like SR21000 and a few other cultivars showed further decline in germination speed with time (Figure 3).
- Minor differences were observed among cultivars for establishment speed cover at 1 MAP with majority showing ≥ 50 establishment cover for both runs (Table 1).
- At 2 MAP, cultivars for both runs had $\geq 90\%$ cover and at 9 MAP, all reached 100 % establishment cover (data not shown) (Table 1).
- Data collected during 32 WAP (winter and spring green up) revealed minor differences among KB cultivars and most cultivars had $>98\%$ vegetation cover when compared to the Legend and Acoustic ($<93\%$) (Table 1).
- Data shows a positive but weak relationship between germination speed IC50 and establishment speed across (D50) (Fig 5) which is because germination show influence between 20-30 days when seeds are planted and during tillering stages and after that no differences.

TAKEAWAY

- Aggressive classification types as assigned by seed companies did not show much establishment differences and fast germinating KB cultivars did not carry that over to establishment speed in field.
- Fast germinating cultivars can be useful for overseeding, suppress weed encroachment and disease and reduce initial management cost.
- This information will help homeowners, field managers and sod growers in their selection of cultivars to promote a sustainable greenspace.

FUTURE DIRECTION

- Measuring aggressive vertical (shoot) growth of these cultivars in field.
- Understanding the regrowth potentials of these cultivars to confirm aggressive classifications.

Acknowledgments and Reference