Mungbean trial 2024 Minnesota

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Visual assessments

Visual plot assessments were taken on July 16 2024 by Jesse.

Of the 409 entries/plots, 387 were scored (the remaining were missed due to a navigation error during scoring the trial.

Of the 387 plots scores, 349 were genotypes/breeding lines and the remainder were the two check varieties (Albert Lea and OK2000).

Table 1: Visual assessment observation counts

type	n
Albert Lea	19
OK2000	19
Breeding lines	349

Each line only had one rep, but two check varieties were diagonally replicated throughout the trial.
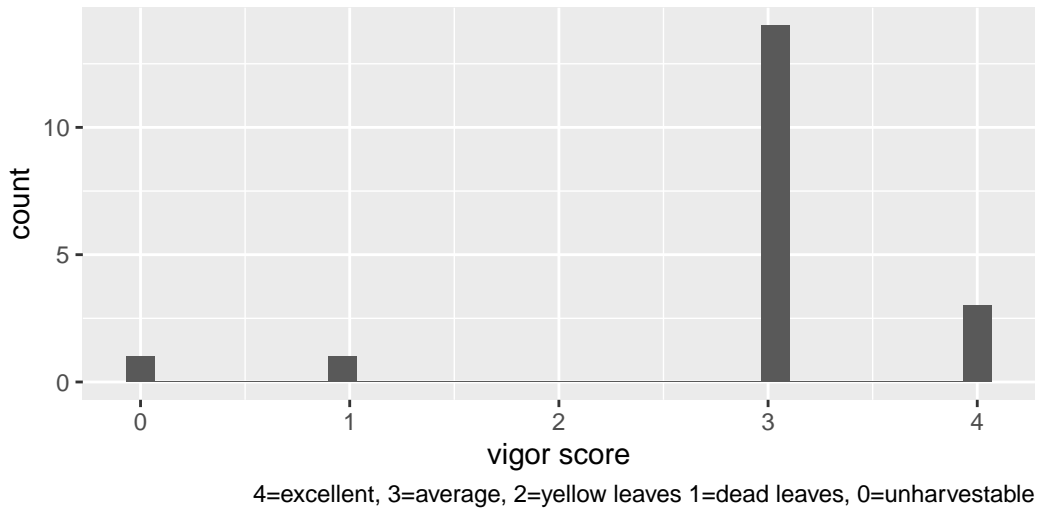
Of the 387 scored plots

- 33 were notable for exceptionally good vigor.

- 21 genotypes had notable yellow leaves.

- 35 had notably dead leaves.

- 47 were deemed unharvestable due to poor population and stature.

- 63% of plots had sufficient population for a whole plot combine harvest and many were likely adjacent to a plot with insufficient population, resulting in border effect which would overestimate yield potential.
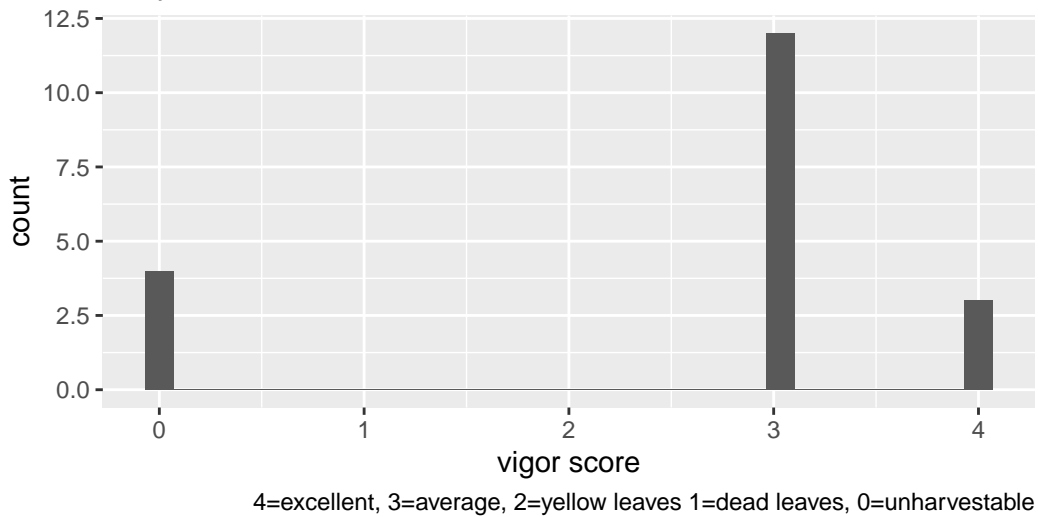
Vigor scores

All scored plots

4=excellent, 3=average, 2=yellow leaves 1=dead leaves, 0=unharvestable
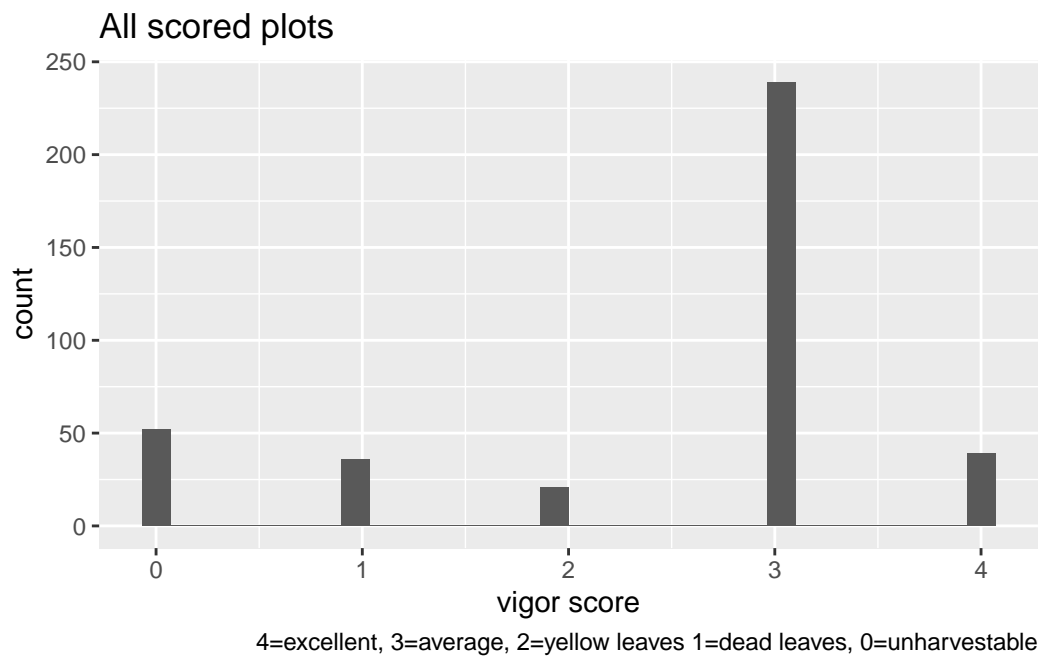
- 239 of the 387 scored plots, or 62% were scored as average vigor.

Only a commercial variety from Albert Lea Seeds

4=excellent, 3=average, 2=yellow leaves 1=dead leaves, 0=unharvestable

Only OK2000

4=excellent, 3=average, 2=yellow leaves 1=dead leaves, 0=unharvestable

- check plots were the only germplasm with replication throughout the trial. We expect their vigor to be similar and average around 3, but some plots were scored as unharvestable and others scored as exceptionally good vigor.

- This could be due to true variation or data collection/entry error.
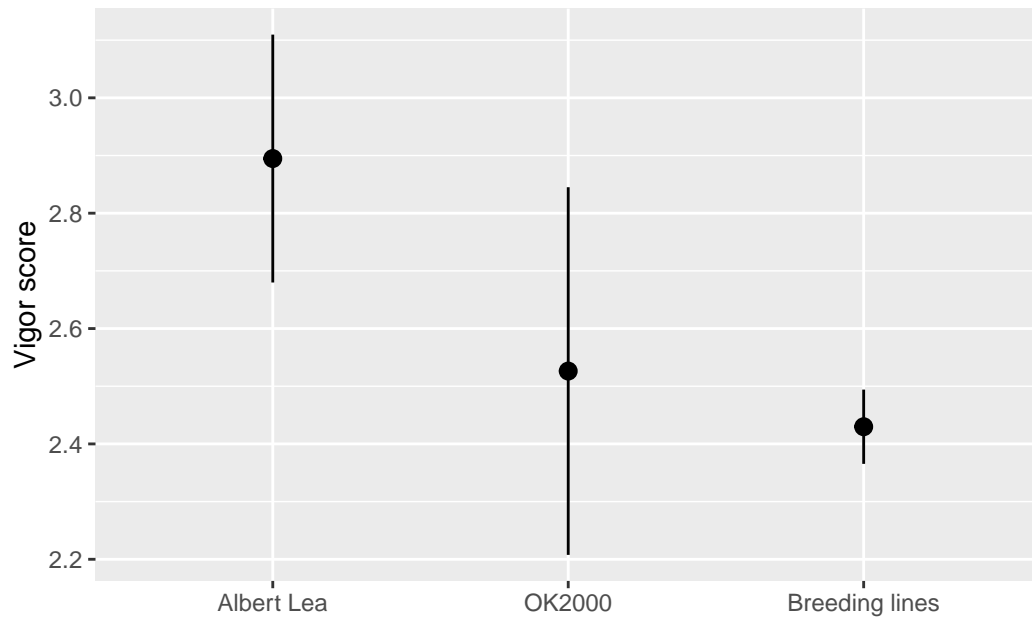
- On average, the two check varieties averaged better vigor than the breeding lines.

Population scores

One of the key assumptions of the trial design we selected was they each plot or entry (2 ft x 10 ft) would have 2 rows of mungbeans at a sufficient population to form a canopied row. If this occurs, then all plots experience the same row spacing and can be combine harvested without any border effect from alleys.

Unfortunately, many plots did not score a "2" during the July visual assessment, meaning they did not have 2 rows with sufficient population. At this point, you cannot take a combine harvest of the plot because the seed yield of that plot will not represent the yield potential of the genotype but rather the effect of insufficient population on yield.

When there is insufficient population, this also impacts adjacent plots. If a genotype is next to a plot that has a lower population, it will experience less competition and perform better. So many plots that scored a "2" were also compromised because they were adjacent to plots that were not a "2". I now realize this is another advantage of border or quadrat harvests within plots because it shelters the plot from the effects of the adjacent plot.

Overall, *we expected like 95% of plots scoring a "2", in reality, this was 63%.*

Table 2: population scores where a 2 is a sufficient population

rowcode	n	percent of total (%)
0	61	16
1	82	21
2	244	63

- 244 of the 387 scored plots, or 63% had sufficient population for a combine harvest.

- Many of these plots likely also experienced border effect from adjacent plots with insufficient population.

Table 3: population scores of the n=19 Check 1 (Albert Lea)

rowcode	n	percent of total (%)
0	1	5
1	4	21
2	14	74

Table 4: population scores of the n=19 Check 2 (OK2000)

rowcode	n	percent of total (%)
0	4	21
1	2	11
2	13	68

- There was no obvious difference between check varieties (which we'd expect to have a sufficient population to form a canopied row) and the breeding lines. Insufficient population seems to be randomly distributed throughout the trial, possibly due to in-field variability, planter performance, how we planted the trial or a data entry error when taking these visual scores.

Yield

Yield data was collected on 7Nov for hand harvest and 12Nov for combine harvest.

14 plots were selected for hand harvest based on visual assessment data to get a variety of vigor scores.

22 "plots" were harvested by the combine, but their ID was unknown. Only the square footage of area harvested was known. This was just done for comparing combine to hand harvest.

We learned

- Of plots where we had a sufficient mungbean population and hand harvested, we averaged around 1000 lbs A of seed which is exactly what we'd expect. See Table 5.

- Despite samples sitting in the field and deteriorating, we still achieved yields above 1500 lbs A, which was identified as the yield necessary to beat a soybean harvest of 50 bu A with a mungbean price of 2X of soybean (Extension and Outreach 2024).

- Combine harvest required a lot of border plots to dial in settings and an unreasonable amount and quality of sample to use the on-board scale and sensors for determination of yield, moisture and test weight.

- The combine underestimated yield compared to the hand harvested sample by about 50%.

Hand harvest

Figure 1: Hand harvested sample after drying, belt threshing, sieving and aspirating. This is considered "partial cleaning" because stems and bits of dirt remain.

Did we get reasonable mungbean seed yields in MN? Yes

Table 5: Expected mungbean seed yields (lbs / A) based on what sources consider average, high and low

Average	High	Low	Source
1000	1200		Extension and Outreach (2024)
	2000+	300	Oplinger et al. (1990)

Table 6: Mungbean seed yield estimation (lbs / A) from hand harvest on 7Nov2024 and partial cleaning. These estimates are likely overpredicted due to some dirt remaining in sample. These estimates are also underpredicted because they include plots with insufficient population

mean	max	min	n
873	1853	134	14

Table 7: Mungbean seed yield estimation (lbs / A) from hand harvest on 7Nov2024 and partial cleaning. These estimates are likely overpredicted due to some dirt remaining in sample. Plots with insufficient population are filtered out

mean	max	min	n
1004	1853	322	7

**Do all the subsamples score a 2 for population score? No**

Table 8: Not all of the 14 hand harvested plots had a population score of 2, meaning they had sufficient population for a combine harvest

PLOT	genotype	rowcode	vigorcode_num	yield_lbsA
253	PI 363657	0	0	912
254	albert lea	0	0	1441
297	PI 364167	0	0	600
23	PI 363565	0	2	134
286	PI 425577	0	2	471
319	PI 425330	1	3	1292
342	PI 425271	1	3	351
331	PI 377349	2	1	322
353	PI 364049	2	1	600
165	PI 377256	2	2	715
341	PI 363324	2	3	1128
275	PI 425425	2	4	1853
276	PI 425822	2	4	1738
320	PI 363988	2	4	667

Do plots with higher vigor ratings have higher seed yields when variable population is controlled for? Yes

Table 9: Mungbean predicted seed yield (lbs / A) of hand harvested plots with a sufficient population for a whole plot harvest grouped by vigor class rating

Vigor code	mean	max	min	n
1	461	600	322	2
2	715	715	715	1
3	1128	1128	1128	1
4	1420	1853	667	3

4=excellent, 3=average, 2=yellow leaves 1=dead leaves
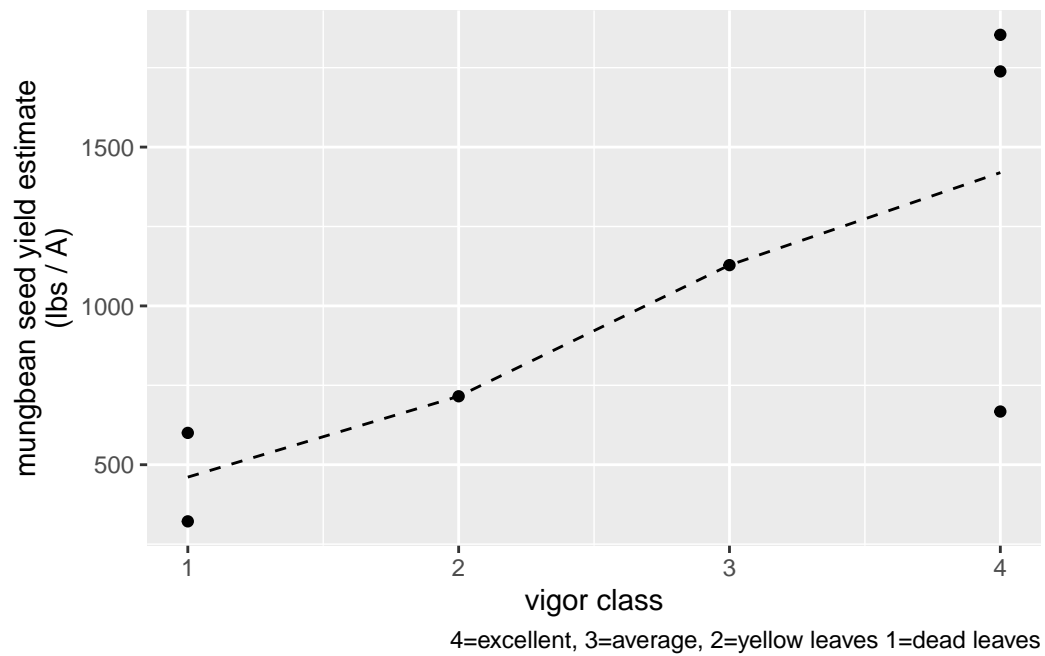
Combine harvest

Figure 2: Harvest sample out of combine. Soybean concave at 5mm distance, drum speed at 540 rpm, fan speed at 2850 rpm, adjustable seive at 3, whole system blow wide open at 8 to both outlets

Table 10: Comparison of seed yield estimates (lbs / A) of combine harvest data vs. hand harvest

method	mean	max	min	n
combine	471	1394	44	22
handharvest	873	1853	134	14

Table 11: Comparison of seed yield estimates (lbs / A) of combine harvest data vs. hand harvest, grouped by harvest area

method	harvest_sqft	mean	max	min	n
handharvest	20	873	1853	134	14
combine	20	453	1394	44	11
combine	40	488	871	109	11

- A plot is 20 square feet. We did 1 pass of eleven plots where we harvested 1 plot at a time, and then did an additional pass were where harvested the entirety of the header width which is about 4 ft resulting in an estimated harvest square feet of 40, just to see if it would be different. It doesn't appear it to have changed yield estimates much.

Bibliography

Extension, Iowa State University, and Outreach. 2024. "Mungbean." https://www.extension.iastate.edu/alternativeag/mungbean.

Oplinger, E. S., L. L. Hardman, A. R. Kaminski, S. M. Combs, and J. D. Doll. 1990. "Mungbean." *Alternative Field Crops Manual.* https://corn.aae.wisc.edu/Crops/Mungbean.aspx#:~:text=Yield%20Potential%20and%20Performance%20Results,large%20as%20main%20crop%20yields.