Project No. A8317
Date: August 16, 2018
Humboldt, Saskatchewan

Test Summary Report

The Effects on Soybean Placement Using a Seed Brake on an Air Seeder Disc Drill Opener

For:
Airguard Inc.
Abbotsford, British Columbia

PAMI
Innovative Solutions for Agriculture and Beyond

A8317
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1. Executive Summary

Airguard Inc. (the Client) manufactures and sells a seed brake for use with air drills. They have tasked the Prairie Agricultural Machinery Institute (PAMI) to evaluate the effect of a seed brake on an air drill's seed placement as tested with soybeans with a disc drill.

Table 1 shows how the use of a seed brake affected the variability of seed depth by showing the percentage of seeds found within a band within .039 in.(1mm), .19 in.(5mm), and .39 in.(10mm) of the mean depth. Use of a seed brake significantly decreased the variability of seed depth for soybeans seeded with a disc drill (at a 95% confidence level).

Table 1. Summary of data on variability of seed depth with and without a seed brake.

		% of seed depths within		
	Mean depth in. (mm)	**.039 in. (1mm) of mean**	**.19 in. (5mm) of mean**	**.39 in. (10mm) of mean**
No brake	1.6 (41)	20	60	92
Brake	1.4 (36)	22	82	100

PAMI makes no inference to the effects of a seed brake on the seed, emergence, and/or yield. The intention of this work was solely focused on seed depth variation with and without a seed brake.

2. Test Set-up and Procedure

To facilitate depth of seed planting tests for soybeans for Airguard Inc. (the Client), the Prairie Agricultural Machinery Institute (PAMI) prepared the terramechanics soil bin (**Figure 1**) to provide a consistent, repeatable procedure for performing tests with an air drill disc opener tool configuration.

Figure 1. The terramechanics soil bin used for planting soybeans with a disc opener.

Two replications using the disc opener with the seed brake installed and two replications using the disc opener without the seed brake installed were performed along the length of the soil bin, which resulted in four test passes (two treatments x two replications). Test parameters used for passes are found in **Table 2**.

After the planting operation was completed in the soil bin, the crop was left until full emergence had occurred. A sample size of 25 consecutive plants per replication was excavated. The depth was quantified by measuring the vertical distance from the soil surface to the seed depth. The seed depth location was established either by the seed remnant or at the origin of the plant root if the seed was not present (**Figure 2**).

Table 2. The test parameters.

Parameter	Soybeans with Disc Opener
Seed brake type	Airguard 7360
Seed brake vent	Airguard 7357
Speed mph (km/h)	5.5 (8.9)
Depth setting in. (mm)	1 (25)
Seed rate lb/acre (kg/ha)	72 (80.7)
Airspeed without brake fpm (m/s)	3,340 (17.0)
Airspeed with brake fpm (m/s)	1,490 (7.6)
Air hose I.D. in. (mm)	1 (25)
Air hose O.D. in. (mm)	1.25 (32)
Opener tool	John Deere Disc Opener
Soil type	-
Weather data: temp (°C), RH (%), wind (km/h)	Indoor

Figure 2. The seed depth measurement.

Additional information regarding test procedures and parameters is available upon request (address is provided at the end of this report).

3. Testing Results

Test results are summarized in **Table 3**.

Table 3. Summary of mean seed depth and percentage of seed depths within .039 in.(1mm), .19 in.(5mm), and .39 in.(10mm) of the mean depth.

		% of seed depths within		
	Mean depth in. (mm)	**.039 in. (1mm) of mean**	**.19 in. (5mm) of mean**	**.39 in. (10mm) of mean**
No brake	1.6 (41)	20	60	92
Brake	1.4 (36)	22	82	100

Scatterplots showing the depth of seeds are shown in **Figure 3** to **Figure 6**. These plots allow visualization of the variability for each treatment and also show the ±5 mm (±0.19 in) bands.

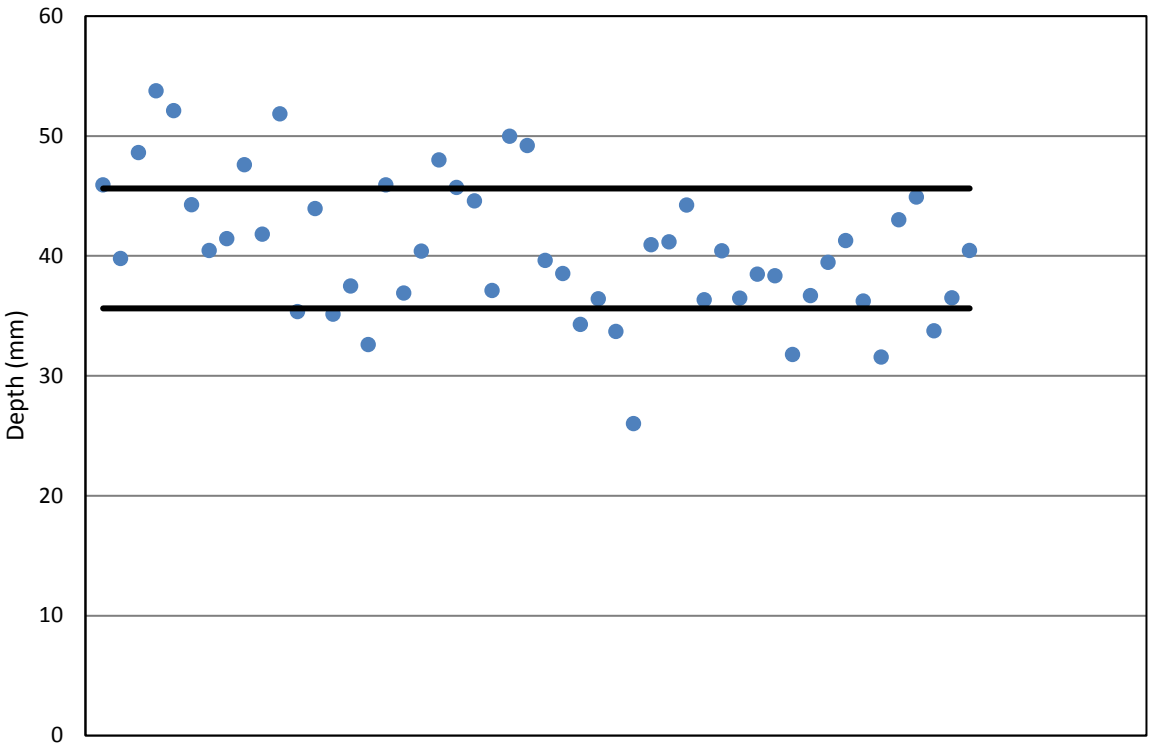


Figure 3. The depth of soybeans placed with no seed brake (50 readings). The black lines represent ±5 mm of the mean depth. 60% of readings were within 5 mm of the mean.

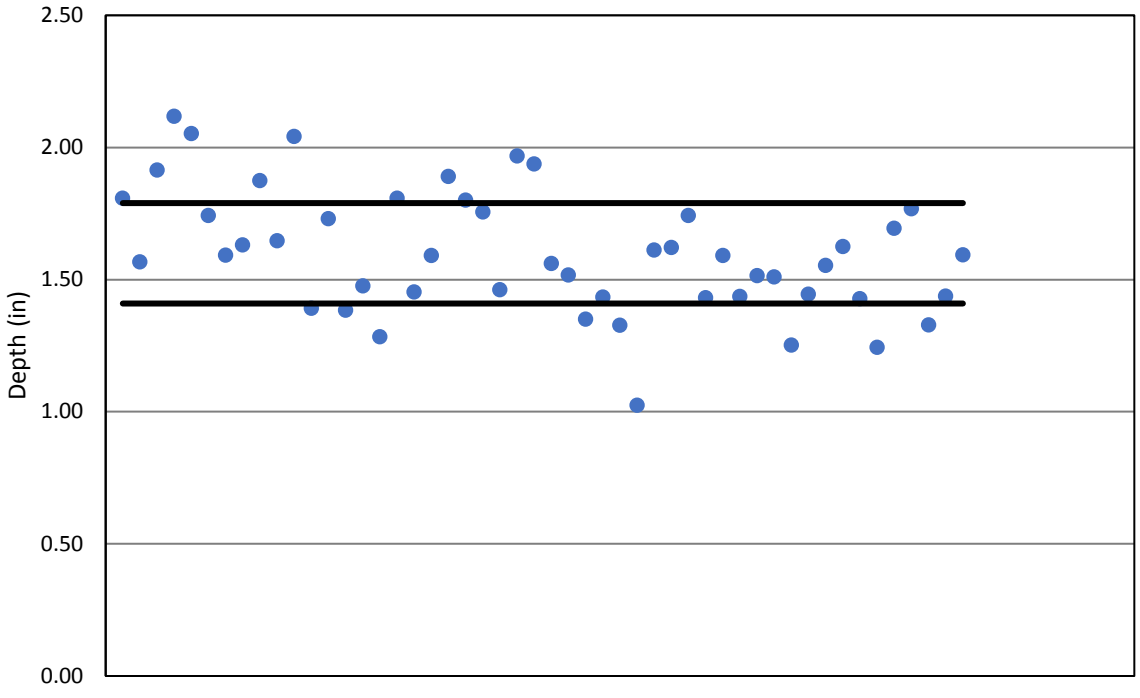


Figure 4. The depth of soybeans placed with no seed brake (50 readings). The black lines represent ±0.19 in. of the mean depth. 60% of readings were within 0.19 in. of the mean.

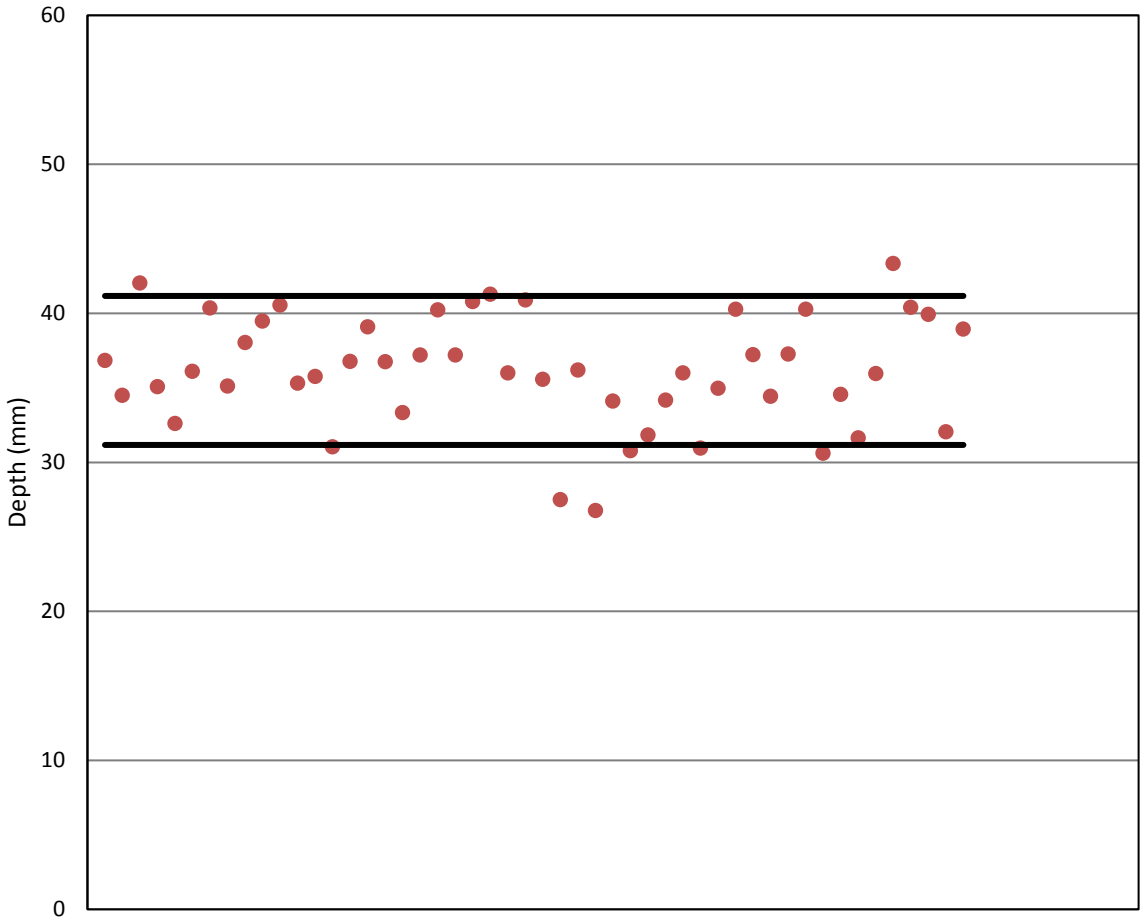


Figure 5. The depth of soybeans placed with seed brake (50 readings). The black lines represent ±5 mm of the mean depth. 82% of readings were within 5 mm of the mean.

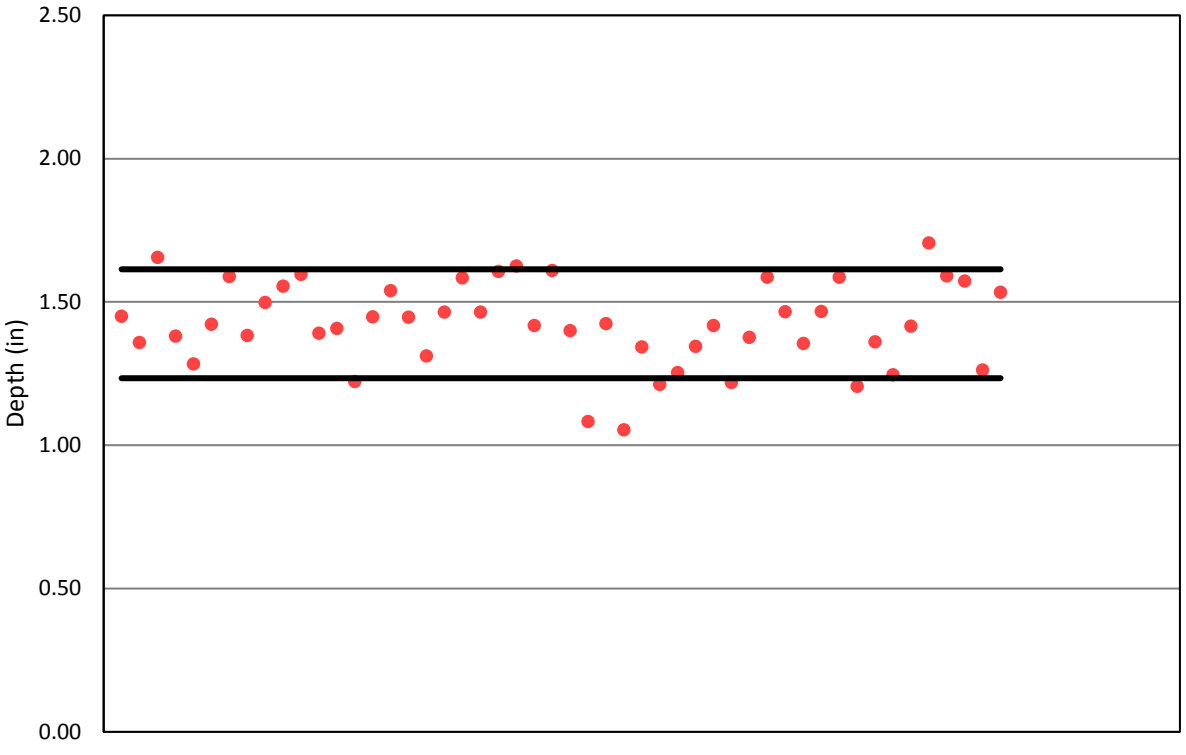


Figure 6. The depth of soybeans placed with seed brake (50 readings). The black lines represent ±0.19 in. of the mean depth. 82% of readings were within .19 in. of the mean.

An analysis of variances using the Bonett method was applied to determine if the seed brake produces a more uniform seed depth. A confidence level of 95% was used to determine significant differences.

Table 4 shows the results of the trial using the Bonett's test of variance at a 95% confidence level. **Appendix A** contains the statistical analysis for the soybean disc opener trial.

Table 4. The bonett test of variance results.

	Mean Depth in. (mm)	Min Depth in. (mm)	Max Depth in. (mm)	StDev in. (mm)	Difference in variability of depth with brake	P Value
No brake	1.6 (41)	1.0 (26)	2.1 (54)	0.2 (6)	Yes	0.003
Brake	1.4 (36)	1.1 (27)	1.7 (43)	0.1 (4)		

This analysis indicates that the use of a seed brake resulted in a statistically significant reduction in the variability of seed depth for soybeans placed with a disc opener (at a 95% confidence level).

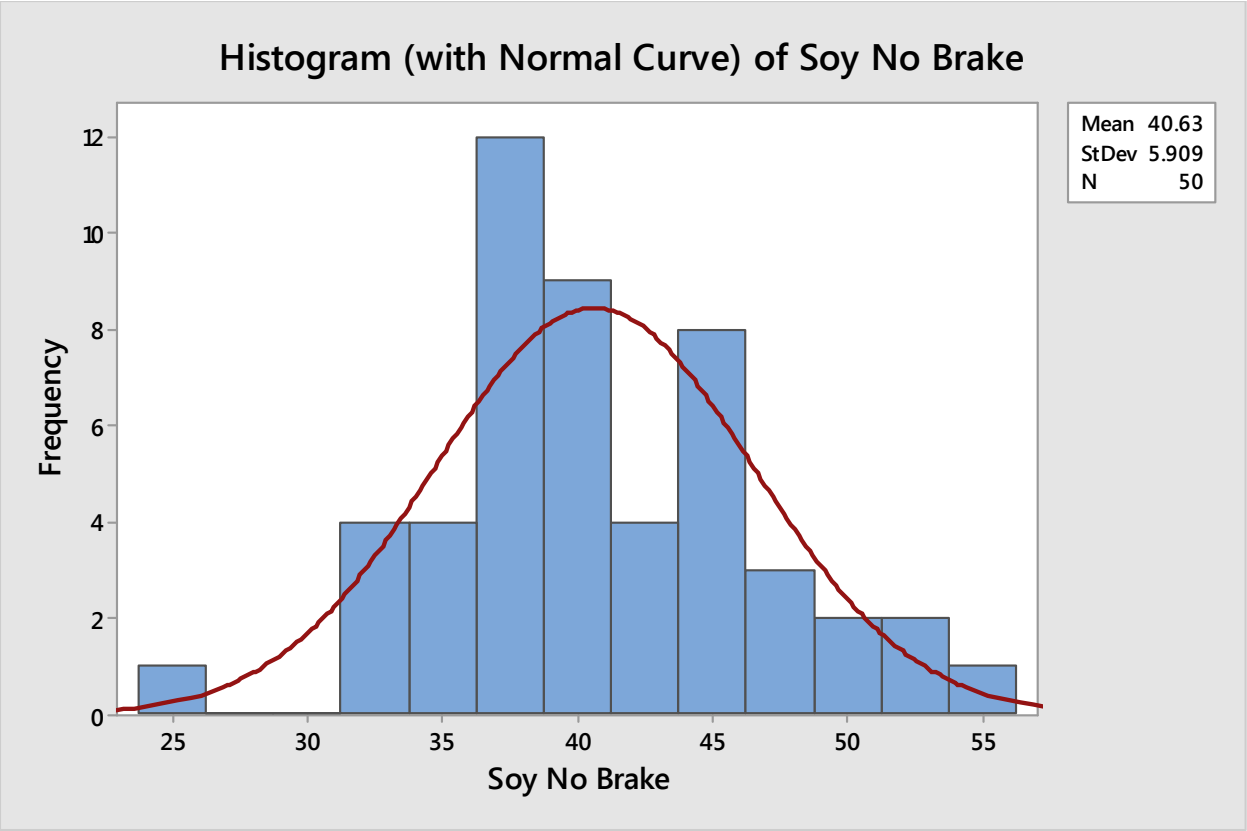
Appendix A

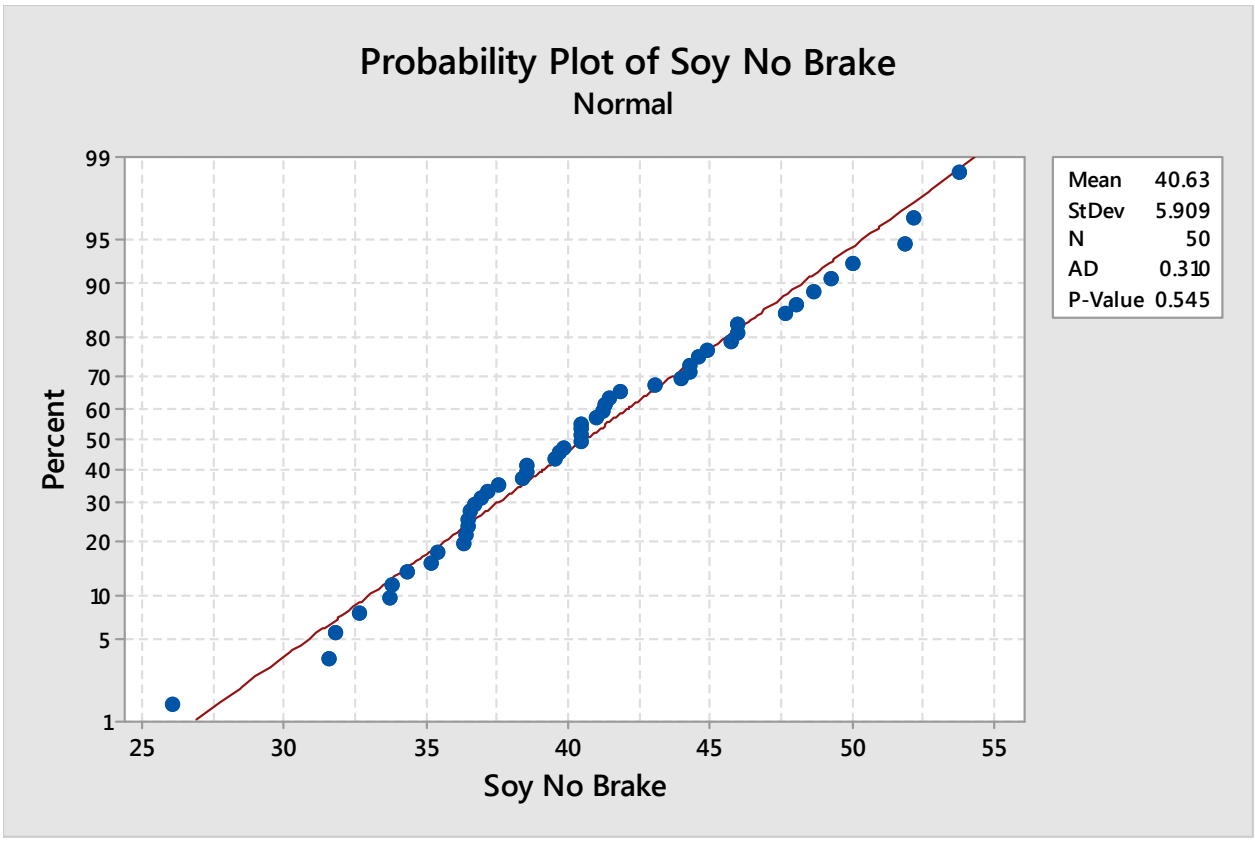
Statistical Analysis of Soybeans Using a Disc Opener

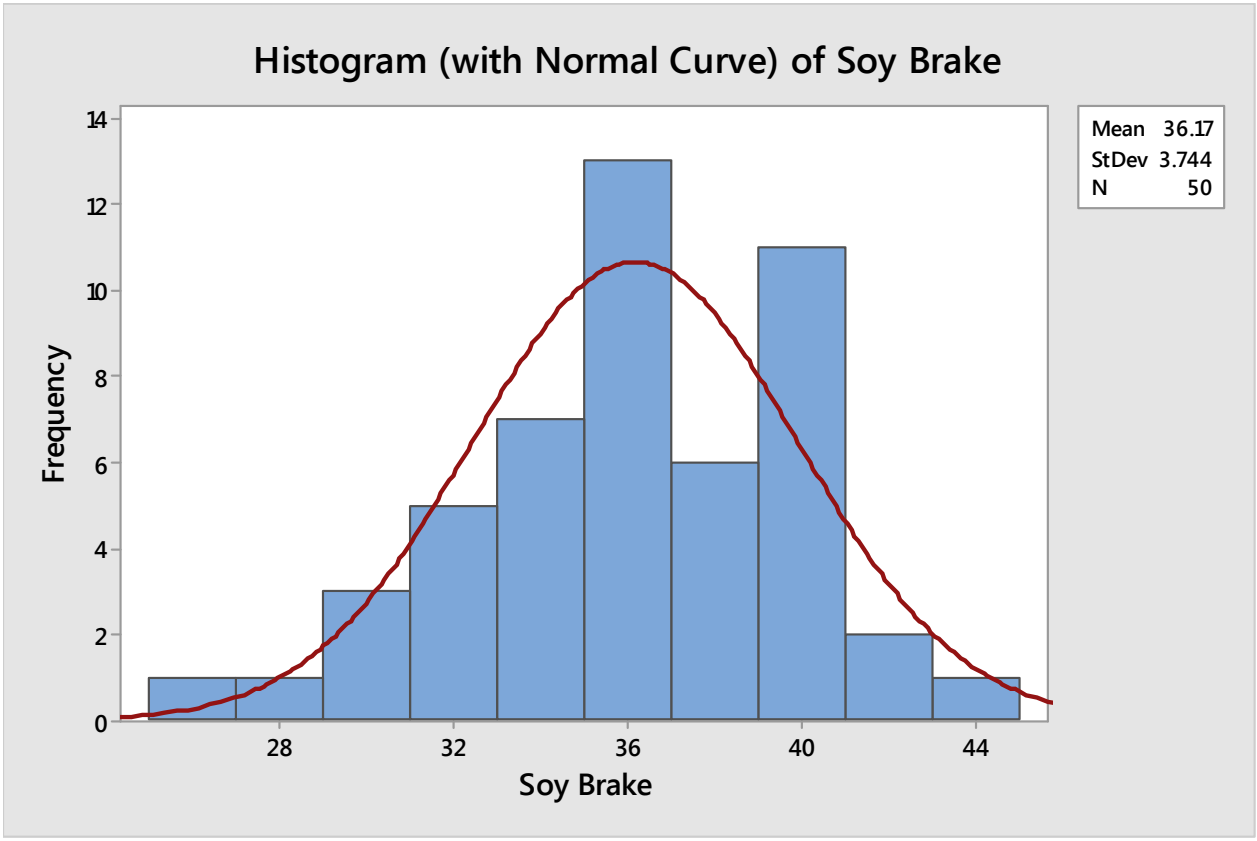
Descriptive Statistics

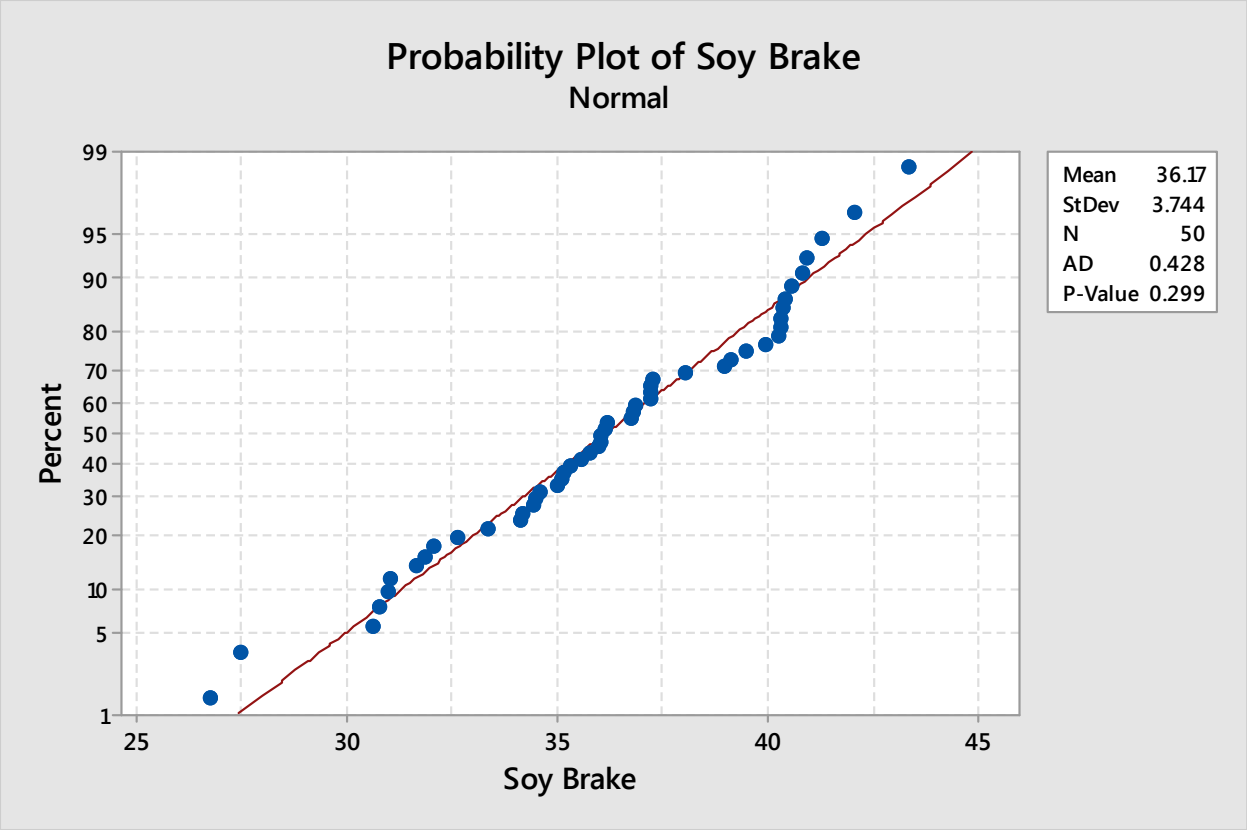
Variable	Mean	SE Mean	StDev	Variance	CoefVar	Minimum	Maximum
Soy No Brake	40.627	0.836	5.909	34.921	14.55	26.040	53.790
Soy Brake	36.167	0.529	3.744	14.016	10.35	26.770	43.340

Test for Normality




Probability Plot of Soy No Brake
Normal
Mean 40.63
StDev 5.909
N 50
AD 0.310
P-Value 0.545
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
25
30
35
40
45
50
55
Soy No Brake


Histogram (with Normal Curve) of Soy Brake
Mean 36.17
StDev 3.744
N 50
Frequency
14
12
10
8
6
4
2
0
28
32
36
40
44
Soy Brake



Test and Confidence Interval (CI) for Two Variances: Soy No Brake, Soy Brake

Method

σ_1: standard deviation of Soy No Brake

σ_2: standard deviation of Soy Brake

Ratio: σ_1/σ_2

The Bonett and Levene's methods are valid for any continuous distribution.

Descriptive Statistics

Variable	N	StDev	Variance	95% CI for σ
Soy No Brake	50	5.909	34.921	(4.948, 7.345)
Soy Brake	50	3.744	14.016	(3.131, 4.659)

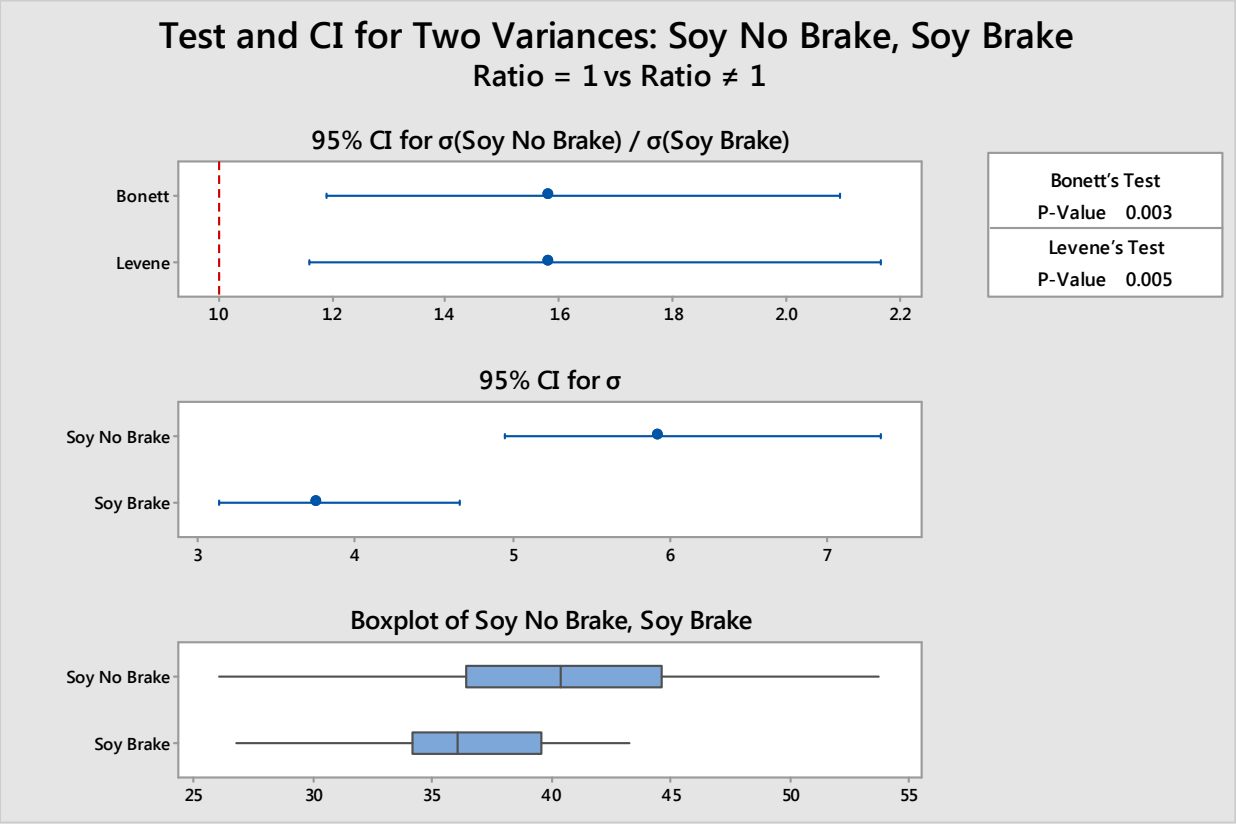
Ratio of Standard Deviations

Estimated Ratio	95% CI for Ratio using Bonett	95% CI for Ratio using Levene
1.57849	(1.188, 2.099)	(1.158, 2.169)

Test

Null hypothesis	$H_0: \sigma_1 / \sigma_2 = 1$
Alternative hypothesis	$H_1: \sigma_1 / \sigma_2 \neq 1$
Significance level	$\alpha = 0.05$

Method	Test Statistic	DF1	DF2	P-Value
Bonett	8.70	1		0.003
Levene	8.13	1	98	0.005



For further information with regards to this report,
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