

USING CHLOROPHYLL FLUORESCENCE SORTING TO IMPROVE SEED LOT QUALITY IN SOYBEAN

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1. INTRODUCTION

WHY SOYBEAN SEEDS ARE USING IN THIS RESEARCH?

- ▶ **Soybean is cultivated in 20.686.800 ha in Brazil.**
- ▶ **In 2007 were produced 58.391.800 Kg of grains (27% of the world production).**
- ▶ **Is not easy to produce soybean seeds with high quality in tropical regions: field stress like high temperatures, dry soil, insects and diseases affects seed maturation and green seeds (chlorophyll is not adequately degraded) may occur and affects the seed quality.**
- ▶ **Green seeds are not removed with efficiency using machines like gravity table and color sorting.**

▶ IS CHLOROPHYLL FLUORESCENCE EFFICIENT TO SORT GREEN SEEDS IN SOYBEANS?

▶ TO ANSWER THIS QUESTION THIS RESEARCH WAS CARRIED OUT.

2. MATERIAL AND METHODS

▶ Five lots of soybean, cv TMG 113 RR, with different percentages of green seeds (0%, 5%, 10%, 15% and 20%), visually selected, were used.

▶ JS2001 Seed Sorter was used to analyse and to sort the seeds.

▶ Germination and controlled deterioration tests were used to evaluate the seed quality.

3. RESULTS

TABLE 1. Chlorophyll fluorescence (pA) of the control and after sorting the seeds.

LOT	Control	Low CF	High CF
1 (0%)	703.8	634.0 _(92.2)	1403.3 _(7.8)
2 (5%)	777.7	609.5 _(90.2)	2133.8 _(9.8)
3 (10%)	1354.2	1086.2 _(86.8)	2811.4 _(13.2)
4 (20%)	1376.3	1064.4 _(83.1)	2556.7 _(16.9)
5 (15%)	1069.3	733.1 _(86.2)	2897.1 _(13.8)

Observation: in red color are the percentages of each fraction in each lot

TABLE 2. Germination test: normal seedling (NS), abnormal seedling (AS), dead seed (DS) and time to 50% of total germination (T50) for the lot 1.

Treatment	NS	AS	DS	T50
Control	89.5 ab¹	5.0 a	5.5 b	2.79 a
Low CF	91.5 a	6.0 a	2.5 c	2.69 a
High CF	80.0 b	11.0 a	9.0 a	2.71 a

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 3. Germination test: normal seedling (NS), abnormal seedling (AS), dead seed (DS) and time to 50% of total germination (T50) for the lot 2.

Treatment	NS	AS	DS	T50
Control	88.0 a¹	7.0 a	5.0 a	2.65 ab
Low CF	92.0 a	4.0 a	4.0 a	2.49 b
High CF	75.0 b	16.0 b	9.0 a	2.83 a

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 4. Germination test: normal seedling (NS), abnormal seedling (AS), dead seed (DS) and time to 50% of total germination (T50) for the lot 3.

Treatment	NS	AS	DS	T50
Control	81.5 a¹	13.0 a	5.0 b	2.44 b
Low CF	90.0 a	8.5 a	1.5 c	2.44 b
High CF	69.5 b	17.5 b	13.0 a	2.68 a

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 5. Germination test: normal seedling (NS), abnormal seedling (AS), dead seed (DS) and time to 50% of total germination (T50) for the lot 4.

Treatment	NS	AS	DS	T50
Control	81.0 a¹	14.0 a	5.0 b	2.52 b
Low CF	86.5 a	12.0 a	1.5 b	2.45 b
High CF	60,5 b	18.0 a	21.0 a	3,00 a

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 6. Germination test: normal seedling (NS), abnormal seedling (AS), dead seed (DS) and time to 50% of total germination (T50) for the lot 5.

Treatment	NS	AS	DS	T50
Control	78.5 ab¹	12.0 a	9.5 b	2.58 ab
Low CF	89.5 a	8.0 a	2.5 c	2.44 b
High CF	59.0 b	17.5 a	23.5 a	2.85 a

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 7. Controlled deterioration test: normal seedlings (NS), abnormal seedlings (AS) and dead seeds (DS) for the lot 1.

Treatment	NS	AS	DS
Control	72.0 a¹	15.0 b	13.0 ab
Low CF	77.5 a	13.5 b	9.0 a
High CF	51.5 b	27.5 a	21.0 b

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 8. Controlled deterioration test: normal seedlings (NS), abnormal seedlings (AS) and dead seeds (DS) for the lot 2.

Treatment	NS	AS	DS
Control	78.5 b¹	8.5 ab	13.0 b
Low CF	85.5 a	10.0 b	4.5 c
High CF	41.0 c	16.0 a	43.0 a

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 9. Controlled deterioration test: normal seedlings (NS), abnormal seedlings (AS) and dead seeds (DS) for the lot 3.

Treatment	NS	AS	DS
Control	44.5 b¹	27.0 a	28.5 b
Low CF	67.5 a	18.0 b	14.5 c
High CF	23.0 c	16.0 b	61.0 a

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 10. Controlled deterioration test: normal seedlings (NS), abnormal seedlings (AS) and dead seeds (DS) for the lot 4.

Treatment	NS	AS	DS
Control	45.5 b¹	21.5 a	33.0 b
Low CF	60.5 a	23.5 a	16.0 c
High CF	19.0 c	14.0 a	67.0 a

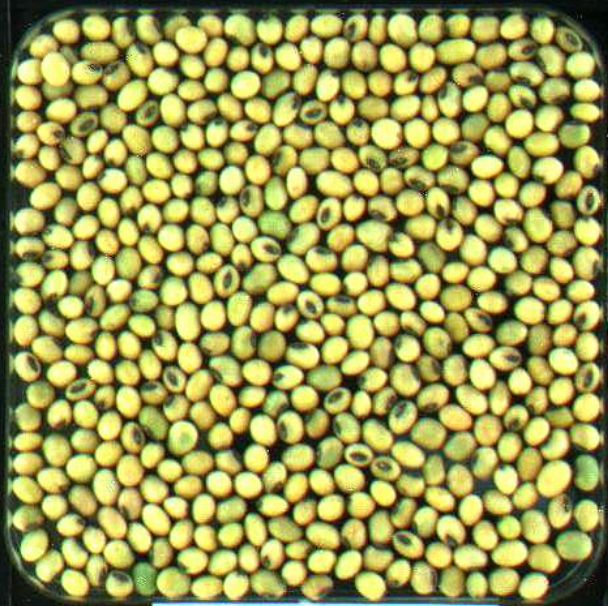
¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

TABLE 11. Controlled deterioration test: normal seedlings (NS), abnormal seedlings (AS) and dead seeds (DS) for the lot 5.

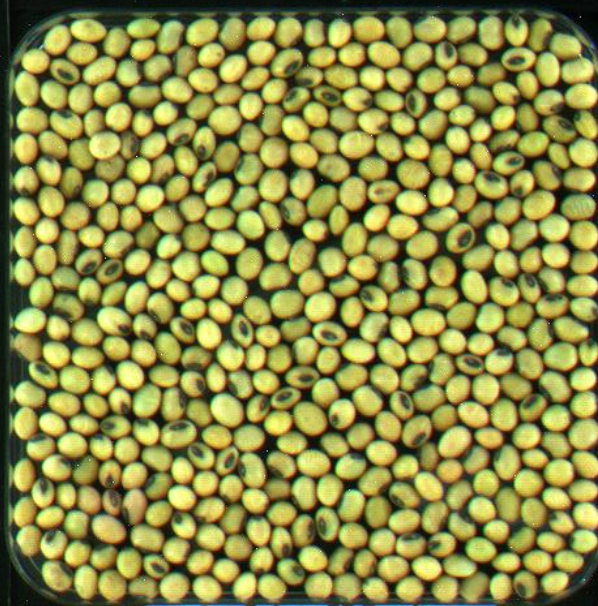
Treatment	NS	AS	DS
Control	52.5 b	14.5 a	33.0 b
Low CF	72.5 a	14.5 a	13.0 c
High CF	12.5 c	15.5 a	72.0 a

¹Means followed by different letters in each column are different by Student's t-test (level of significance: $\alpha = 0.05$)

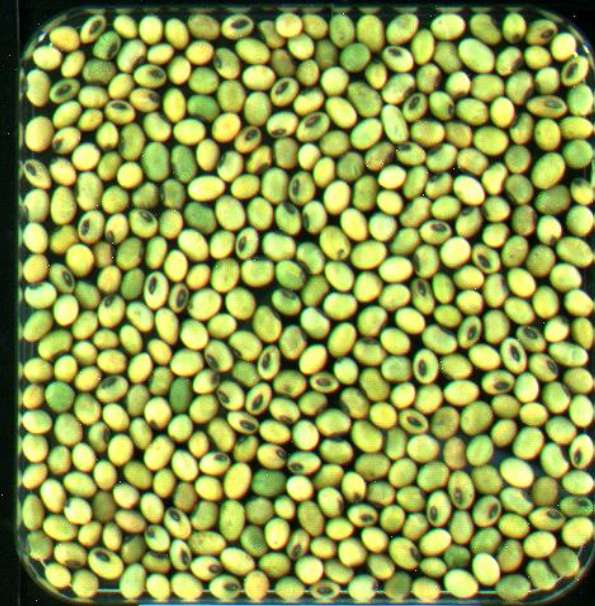
FIGURE 1. Images of the seeds (lot 5) before sorting (control) and after sorting (low chlorophyll fluorescence and high chlorophyll fluorescence)



Lot 5: Control



Lot 5: Low CF Fraction



Lot 5: High CF Fraction

FIGURE 2. Images of the normal seedlings, abnormal seedlings and dead seeds after de controlled deterioration test for the lot 5.

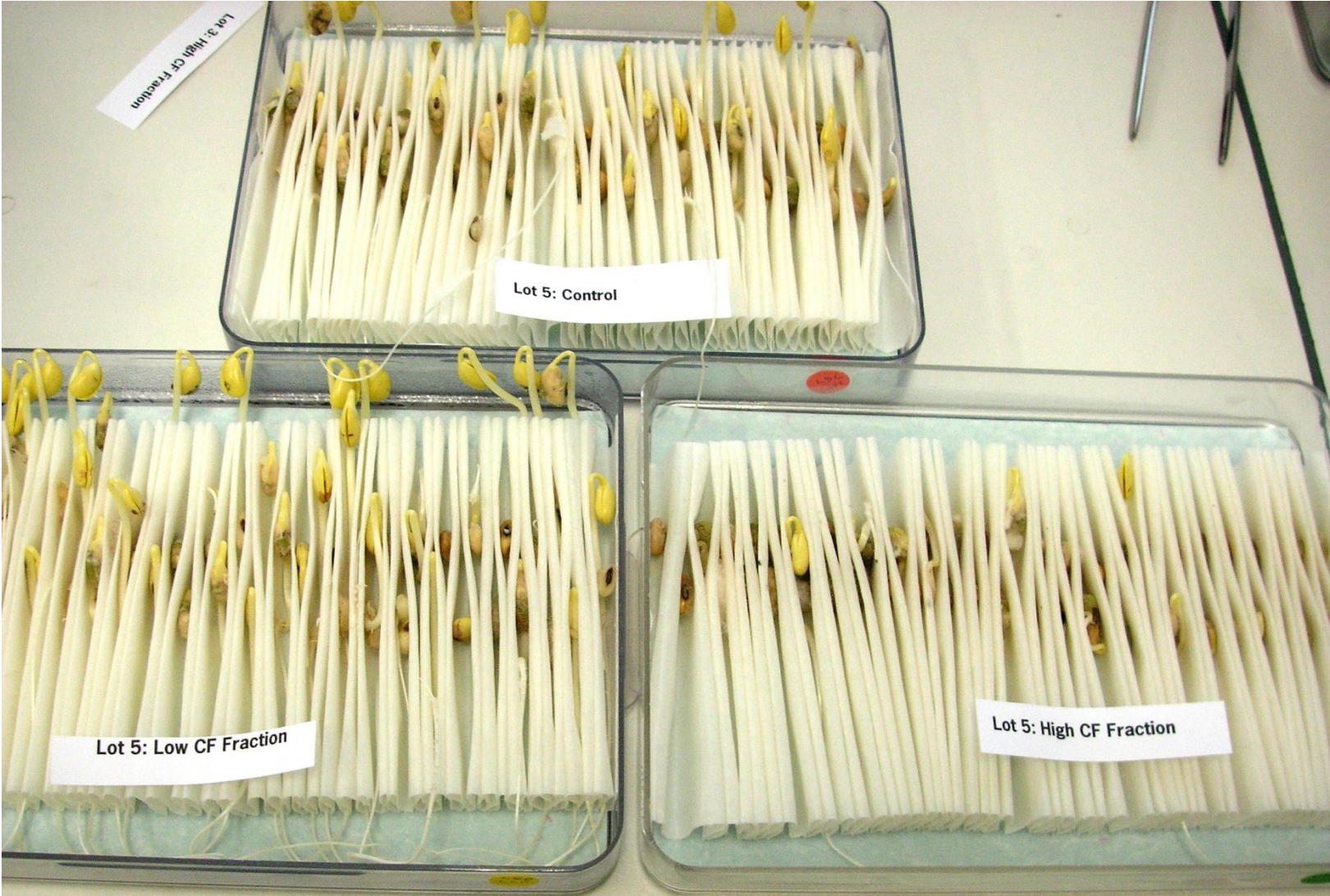


FIGURE 3. Images of the normal seedlings, abnormal seedlings and dead seeds after de controlled deterioration test for the lot 5 – low chlorophyll fluorescence fraction.



FIGURE 4. Images of the normal seedlings, abnormal seedlings and dead seeds after controlled deterioration test for the lot 5 – high chlorophyll fluorescence fraction.



4. CONCLUSIONS

Green seeds present high chlorophyll fluorescence and affect the quality of the seed lot.

The chlorophyll fluorescence is very efficient in sorting green seeds in soybean, consequently to improve the seed lot quality.

THANK YOU!!!





Levels

Sort detected seeds
above [pA]

Detect seeds above
noise [pA]

CF signal monitor



Resistor / Test Measurement

Total resistance

Frequency 10-1500 [Hz]

Phase 0.000 [degrees]

Dynamic range 1 [bits]

Seeds used to calculate top

Stop size [pA]

Data

Seeds detected

Seeds sorted

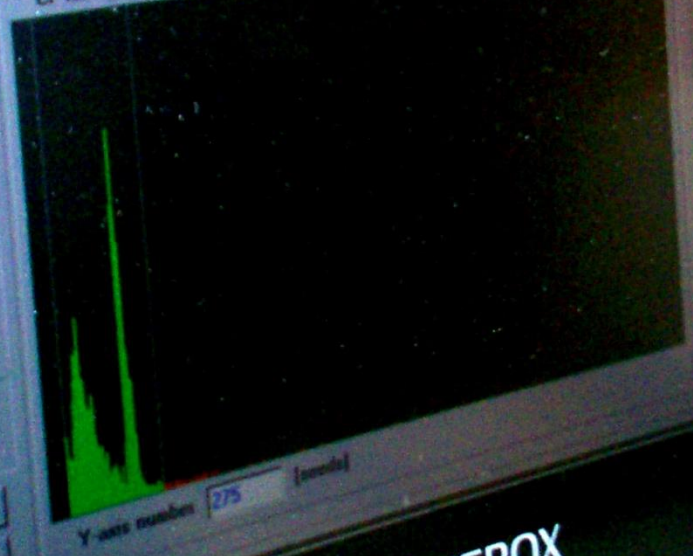
Fraction [%]

Mean CF

Sigma CF

Analyse
 Sort

CF histogram



Electro settings

As single shot

Power

As multi shot

Power

Stochastic

Power

XEROX

