

Development of a coating technique in sunflower seed (*Helianthus annuus* L.)

SOLA, S., PETIT, C., DELPIANO C. and PETTAZZI J.

RIZOBACTER ARGENTINA S.A. Av. Dr. Arturo Frondizi 1150. Calle N° 1-Parque Industrial-Pergamino, Bs. As. Argentina

E-mail: ssola@rizobacter.com.ar

Abstract

- The technique of seed coating, with calcium carbonate, as an inert, is known and applied to forage and horticulture seed to increase size and better uniformity, but in sunflower, the loosening of the coating cover (calcium carbonate), makes handling and planting quite difficult.
- Motivated by the need to increase and standardize the size of sunflower seed, and at the same time incorporate a correct dosage of fungicides and insecticides in the coating, without affecting germination power and seed quality, an industrial technique was developed for coating seeds with an inert organic material.
- Lab experiments were run with a machine that has a variable centrifugal speed, operated manually, with a small batch processing capability. Larger tests were performed on running an automatic centrifugal machine where the batch drums have spinning disks coated with a polyurethane surface that causes an even distribution of coating material on the seeds. Dosing system consists in direct injection pumps which generate the coating layers. Coating was applied to different sunflower hybrids combined with different pesticides.
- Pelleted seeds increased; Length in 0,550 mm. Width in 0,457 mm. Thickness in 0,587 mm; as an average. Germination values obtained in the laboratory, showed no significant differences between natural and pelleted seeds up to 240 days. Pelleted seeds had 93 % to 99 % of Germination Power (GP) and non-pelleted had 98 % of GP. Sowing in the field showed that in the seeding line, pelleted seed had, 5 plants /m spaced at 0,20 m between each plant. In control seeds (not pelleted) there was 8 plant/m spaced unevenly in the seeding line. After sowing there was no residue of coating in the container of the seeding machine, nor under the seed distribution plates.
- The pellet with an inert organic material is a technique applicable to sunflower seeds, for favoring, seed size increase and uniformity. Seed protected against disease and insects with no loss of coating, at the same time keeps good germination power and improves seed quality.

Keywords: distribution, homogeneity, inert, sunflower, coating

Introduction

Sunflower seed (*Helianthus annuus* L.) Botanically called achene, is generated in the inflorescence (flower head) in different sizes as a result of the influence of environment and genetics, among other variables. This does not mean difference regarding bio-variables quality. Different sizes of seed are a serious problem for companies that process and classify sun flower seed. When hybrid varieties are prepared there is a significant quantity of, “off caliber” sunflower seed disregarded.

Homogenization of size and volume increase has been achieved in other species by seed coating, commonly known by pelleting or incrustated or inlayed, which consists of an inert mineral inlayed on the seeds. This long-standing technique was first patented in 1868 but had no further application until in 1940 when Mr. Volgisang promotes the production and marketing of coated seed.

A primary objective for maximum expression of yield potential of sunflower is to achieve an adequate population and distribution of plants. Both factors depend on the capacity of the seeding machine’s feeder to deliver the seeds one by one. Use of calibrated seed and adjustment of the planter, is a basic starting point that contributes to achieve, as a goal, an increase of yields, (Ormeño 2001).

The yield of sunflower and its oils function of a good leaf area during the grain filling stage, as a consequence of the ability to intercept most of the available sun light. The optimization of the population and spatial distribution of plants helps accomplish these objectives. “Crop management”. (Aguirrezabal et al 2001).-

In field trials, examination showed that seed size does not affect the rate of germination and emergence. However, plants from smaller seeds showed smaller leaf area, less height and a decrease in dry matter, than those of larger seed during the days that follow emergency. These differences in plant growth later disappeared without affecting the performance in tests in which plots were sown with large seeds and small ones separately. On the other hand, although germination was not affected by the size of seed, under laboratory conditions, the rate of imbibition was lower in bigger seed, due to a greater separation between the pericarp and the seed itself. This could be a disadvantage in field conditions with low soil moisture or a poor soil-seed contact because duration of time between sowing and emergence would be greater in larger seeds. (Aguirrezabal et al. Al. 2001).

The seed coating with calcium carbonate has from the physiological point of view a good behavior in Sunflower. (Szemruch et al 2010) but has problems in field planting because of breakage and loss of coating. Motivated by the need to standardize the size of the sunflower seed, an industrial technique was developed by coating seed with an inert material of hemicelluloses (FIX 10).

Materials and Methodology

The sunflower seed coating treatment trials in laboratory were run with a small machine designed for manual control with a processing capacity of 1 kg of natural seed/batch.

Large-scale tests were run on a total of 200 kg of sunflower seeding an automatic centrifugal machine that consists of two bins of stainless steel withal capacity of 100kg of seeds/batch each. The bins have central rotating disks with a polyurethane surface that facilitates an even distribution of coating material on the seeds. The dosing system consists of directing ejection pumps fitted with a flow meter that controls the coating layers on the seed.

Evaluation tests performed were:coating resistance(RR): The first trial was done on 19/12/2008 at Acevedo, Pergamino Province of Buenos Aires, using a14-rowdirect seeding planter, Tedeschi Argentine make. The second trial was done on 15/01/2010 at Ferre, District of Colon Province of Buenos Aires, with a 10 row direct seeding machine Super Walter Argentine make. Seed dimensions (MS): ZL-were done with a standard metal caliper that has a resolution of 0.02 mm. Germination (PG): was done during 8 day son sand trays in a chamber at 25 ° C and 60% humidity, shifting eight hours of darkness with 16

hours of light during the 8 days.4 replicates were planted with one hundred seeds each according to (ISTA, 2010) registering the percentage (%) of normal new bred plants. Determinations were performed with a germination rate of 30days up to240 days. The variables observed in each trial (RR, MS, PG) were examined statistically.

Results and Discussion

With pilling or pelleting technology, standardization and increase of the size of sunflower seed is achieved (Table 1) and (Graphic 1).-

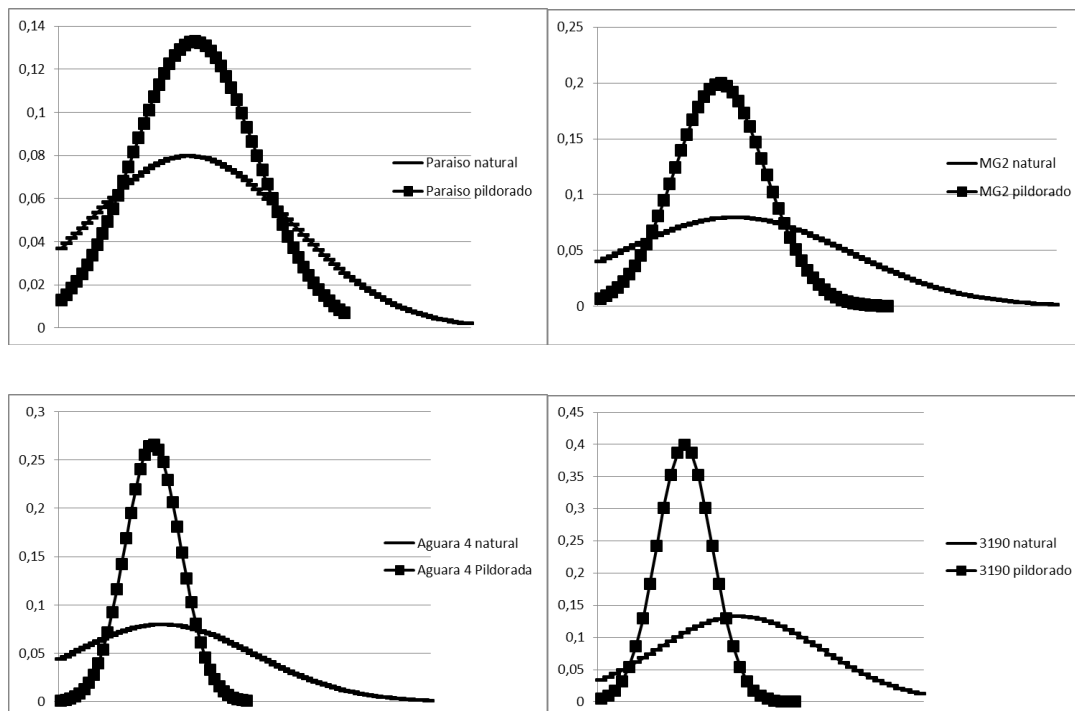
Table1: Evaluation of Sunflower pelleted seed

Hybrid	Natural Seed /mm						CoatedSeed /mm					
	Long mm	stand. Dev.	Width mm	stand. Dev.	Thickness mm	Stand. Dev.	Long mm	Stand. Dev.	Width mm	Stand. Dev.	Thickness mm	Stand. Dev.
S. Paraiso Dow	9,22	1,36	4,3	0,56	3,21	0,57	9,65	1,23	4,77	0,78	3,72	0,78
MG2	11,18	1,06	3,99	0,34	2,84	0,46	11,63	0,93	4,64	0,51	3,69	0,49
Aguara 4	8,82	1,58	3,66	0,41	2,46	0,44	9,47	1,02	3,84	0,41	2,93	0,54
SPS 3190	8,74	0,9	3,29	0,39	1,98	0,61	9,41	0,98	3,82	0,34	2,5	0,61

N=20

Analysis of data shows an increase in the length, width and thickness of the different pelleted hybrid seeds compared to no pelleted sunflower seed. Difference is shown on table 2.-

Graphic 1: Thickness of the seed Different Hybrid



The graphs show that pelleted seed increases size and standardizes thickness

Table 2: Difference in size between Pelleted and Natural Sunflower seed.

Hybrid	Difference*Nat.seed / Coated seed in mm
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	long mm	Stand. Dev.	width mm	stand.dev.	thickness mm	Stand. Dev.
S. Paraíso	0,43	0,11	0,47	0,11	0,51	0,23
Dow MG2	0,45	0,17	0,65	0,23	0,85	0,17
Aguara 4	0,65	0,11	0,18	0,24	0,47	0,21
SPS 3190	0,67	0,16	0,53	0,12	0,52	0,1

*Difference between results shows an increase in caliber size.

The durability of coating, prior to planting with mechanical seeding equipment, is another important parameter to take into consideration in the use of sunflower seed pilling technology. The sample for evaluation were taken at the output of the mechanical seeding device and then were quartered to samples of 200grams according to ISTA standards for the evaluation of purity.-

Table3: Evaluation of Coating

Cover	Pure seed/gr		Material Inert/gr			
			Inert gr.		Powder gr.	
check	198	a	1,5	a	0,5	a
Pild Fix 10	197	a	1,8	a	1,2	a
Pild COCa ₃	177	b	18,8	b	4,2	b
mean	190,67		7,37		1,97	
stand.dev.	1,8462		0,9026		0,9655	

The check control (natural seed) and coated seed with coverage Fix10 (standardized mixture of hemicelluloses) and coated seed with Calcium Carbonate, had a similar performance, but a big difference showed regarding loss of coating in the calcium carbonate coated seed.

Table 4: Result Germination

Hybrid	treatment	Germination/ day						
		Initial	30	60	90	180	210	240
SPS 3190	Check	98	100	99	100	100	100	98
	Coat. Metalaxil	96	95	98	95	99	96	93
	Coat. Metalaxil Thiamethoxam	97	96	98	97	98	97	94
mean		97	97	98	97	99	98	95
D, Stand.		0,089	0,987	0,760	0,456	0,231	0,370	0,267
S. Paraíso	Check	90	89	87	88	90	89	86
	Coat. Metalaxil	91	89	87	87	89	88	87
	Coat. Metalaxil Thiamethoxam	90	88	86	88	87	89	88

mean		90	89	87	88	89	89	87
D.Stand.		0,142	0,238	0,673	0,341	0,237	0,329	0,241
Dow MG2	Check	93	90	91	90	89	90	89
	Coat. Metalaxil	92	91	90	89	88	89	87
	Coat. Metalaxil Thiamethoxam	93	90	91	91	90	89	89
Mean		93	90	91	90	89	89	88
D.Stand.		0,312	0,291	0,192	0,271	0,173	0,249	0,154
Aguara 4	Check	91	89	92	88	87	90	89
	Coat. Metalaxil	90	90	90	89	88	91	88
	Coat. Metalaxil Thiamethoxam	89	88	90	89	88	90	88
Mean		90	89	91	89	88	90	88
D.Stand.		0,176	0,435	0,239	0,519	0,391	0,271	0,452

Evaluation of germination (Table 4) shows that the pelleted seed alone or with, fungicide (Metalaxyl) and Insecticide (Thiamethoxam) does not affect the quality of the seed until 240 days after treatment.-

Table 5: Plantability of Pelleted seeds of sunflower

treatment	20 Day from de sowing			
	N° seed /m	D.standar	Dist.between seeds /cm	D. standar
Check	8	0,5673	0,12	4,561
Pil Metalaxil	5	0,439	0,21	0,789
Pil Metalaxil +Thiamethoxam	5	0,3978	0,2	0,8861

n=20

Results showed the number of seeds sown per meter in the control/check were 8 while the pelleted seed was 5 seeds/meter and with a better distribution.-

Pelleting with hemicelluloses is a feasible technique applicable to sunflower seed because it favors homogenization, size uniformity, and spatial distribution and permits an accurate dose of pesticides on the inlayer that recovers the seed. Consequently yield in grain and oil will increase.

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