UNIZEO

LIFE10 ENV/IT/347

Deliverable Action 5: Evaluation report on end product characteristics

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TABLE OF CONTENTS:

Table of content

1 SUMMARY

The final product, registered under the name URELITE©, during the two years of experimentation has progressively acquired considerable improvements in its shape, in the regularity of its dimensions, in the consistency of the granule (hardness) and in its humidity (range %).
From this derives that the experimenting farmer will have more facility in its use, and a more uniform distribution on the soil.
It has to be observed that these characteristics are important for the future exploitability of the product.

In the years 2013 and 2014 samples of supplies to farmers and golf pitches were analysed. The physical and chemical verifications of the covered granules were effectuated on the following parameters:

a) Diameter of the granules deprived from the prilled urea;
b) Diameter of the prilled urea granules covered by a mix of zeolitite and clay (as a natural adhesive);
c) Regularity of the coating zeolitite mix
d) Ratio in p/p matrix (bare urea grain) / coating
e) Ratio in % of coated grains /uncoated grains

2 CHARACTERISATIONS PERFORMED AND RESULTS OBTAINED

Year 2013

a) Diameter of n° 500 bare granules (only prilled urea) verified

Results:

Control of 31/03/13	n° 100	average 2,38 mm
Control of 31/05/13	n° 100	average 2,46 mm
Control of 30/06/13	n° 100	average 2,24 mm
Control of 31/10/13	n° 100	average 2,31 mm
Control of 30/11/13	n° 100	average 2,39 mm
Total average		**2,36 mm**

b) Diameter of n° 500 zeolitite coated granules verified

Results:

Control del 31/03/13	n° 100	average 2,99 mm
Control del 31/05/13	n° 100	average 3,10 mm
Control del 30/06/13	n° 100	average 3,15 mm
Control del 31/10/13	n° 100	average 2,89 mm
Control del 30/11/13	n° 100	average 2,88 mm
Total average		**3,00 mm**

Year 2014

a) Diameter of n° 500 bare granules (only prilled urea) verified

Results:

Control of 31/03/14	n° 100	average 2,096 mm
Control of 30/04/14	n° 100	average 2,085 mm
Control of 31/05/14	n° 100	average 2,184 mm
Control of 30/09/14	n° 100	average 2,120 mm
Control of 30/11/14	n° 100	average 2,140 mm
Total average		**2,123 mm**

b) Diameter of n° 500 zeolitite coated granules verified

Results:

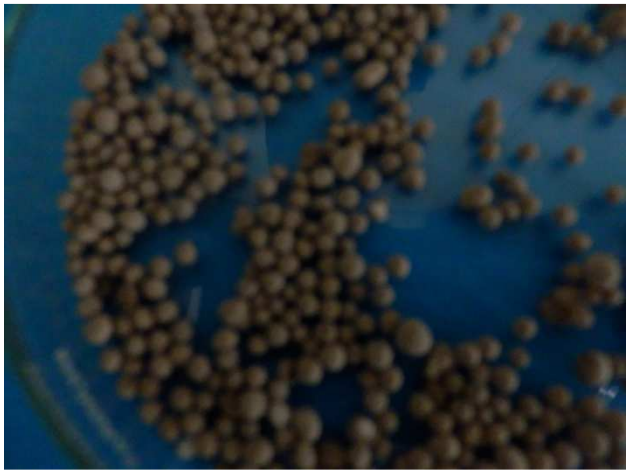
Control of 31/03/14	n° 100	average 3,108 mm
Control of 30/04/14	n° 100	average 3,254 mm
Control of 31/05/14	n° 100	average 3,164 mm
Control of 30/09/14	n° 100	average 3,112 mm
Control of 30/11/14	n° 100	average 2,968 mm
Total average		**3,121 mm**

As can be deducted from the data, there is a significant progressive improvement in the results, from the start of the campaign in 2013 until the end of the campaign in 2014, with highly regular in dimensions of the diameter.

For the determination a caliber with display was used, with a precision of two decimals after the gram (centigrams).
We highlight bare granules of different diameter, resulting in different diameters of urelite (coated urea).

Used caliber

Prilled urea granules



Urelite granules

Verification phases in Medilabor laboratory

From the verifications performed on the samples, diameters of coated granules result to vary with the following average percentage:

URELITE PRODUCTION 2013: = 1,89% (diameters minus + plus deviations)

URELITE PRODUCTION 2014: = 0,74% (diameter minus + plus deviations)

The 2014 production has shown a neat improvement in the presence of anomalous coated granules (diameter minus and plus deviations) as compared with the production of 2013.
This is also due to the minor aggregation of the coated granules among each other, derived from the improvement of the humidity rate that was achieved by a more uniform drying and subsequent cooling before packaging.

RATIO AVERAGE WEIGHT OF BARE PRILLED UREA GRANULES / WEIGHT OF ZEOLITE COATING OF THE GRANULE

The average of the determinations lead to the following results:

Year 2013

Average weight of bare prilled urea granules: 3 tests with 200 granules each

Control of 31/03/13	N° 200	average 1,592 g
Control of 30/06/13	N° 200	average 1,604 g
Control of 30/11/13	N° 200	average 1,587 g
Total Average		**1,594 g**

Average weight of the zeolitite coated urea granules: 3 tests with 200 granules each

Control del 31/03/13	N° 200	average 2,662 g
Control del 30/06/13	N° 200	average 3,047 g
Control del 30/11/13	N° 200	average 3,113 g
Total Average		**2,941 g**

As can be observed the average weight of the zeolitite coating results inferior compared to the average weight of the bare prilled urea granules, namely:

g 2,941 - (average weight of the coated prilled urea granules)
g 1,594 = (average weight of the bare prilled urea granules)
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g 1,347

g 1,594 – 1,347 = - **g 0,247** (figure in disadvantage of the average weight of the zeolitite coating)

This is due to the part of the zeolitite that has not adhered well to the granules and that is still set free: this is demonstrated by the fact that during spreading on the fields trails of dust appeared behind the fertilizer spreader (see the photo below)
It should be noted that this part of free zeolitite (dust) still exercises its soil improving activity to the root system (rizosfera).

Spreading of wheat

Spreading of maize

Year 2014

In 2014 the same tests of 2013 took place.

The average of the determinations led to the following results:

Average weight of bare prilled urea granules: 3 tests with 200 granules each

Control of 31/03/14	N° 200	average 1,576 g
Control of 31/05/14	N° 200	average 1,559 g
Control of 30/11/14	N° 200	average 1,588 g
Total average		**1,574 g**

Average weight of the coated urea granules: 3 tests with 200 granules each

Control of 31/03/14	N° 200	average 3,054 g
Control of 31/05/14	N° 200	average 3,085 g
Control of 30/11/14	N° 200	average 3,298 g
Total average		**3,146 g**

As can be deduced, the average weight of the zeolitite prilled urea coating, in the 2014 production, resulted almost the same as the weight of the bare prilled urea granules, namely:

g 3,146 - (average weight of the coated prilled urea granules)
g 1,574 (average weight of the bare prilled urea granules)
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g 1,572 = (average weight of the zeolitite coating)

g 1,574 / g 1,572

Small variations in weight may be caused as well by the different humidity rate of every single produced lot.

Spreading of maize

Localised spreading of maize

REGULARITY OF THE COATING OF URELITE® GRANULES

Single urelite granules have been sectioned in two essentially identical portions, and the regularity of the thickness of the coating has been assessed, by measuring its thickness.
It should be acknowledged that the regularity of the coating of the prilled urea granule is not very relevant for the performance of the cation exchange, but it assumes a significant importance for the commercial exploitation of the product.
Very important is the ratio weight/product of the bare prilled urea granule with respect to the zeolitite coating, that has to on average equal (50/50).
The regularity of the weight of the coating in respect to the weight of the granule, is an essential indicator for the stechiometric calculation of the capacity of cation exchange of the zeolitite with the ammonium ion (NH4*) that will derive from the lysis of the urea granule in the soil.

Year 2013

Cut urelite granules

Year 2014

Cut urelite granules

In conclusion it has been shown how the regularity of the dimensions of the URELITE granules and the regularity of the coating have improved during the two years of experimentations leading to a good application performance and to achievement of a qualitative standard of the coated urea granules, significantly superior to several other granulated fertilizers present on the market.

RATIO (%) OF BARE PRILLED UREA GRANULES VS COATED GRANULES (URELITE)

Year 2013

From 3 numerical assessments (counting) performed on samples, the following ratio (%) emerged on bare granules with respect to coated granules:

Control of 31/03/13	Bare granules / coated granules > 5%
Control of 31/05/13	Bare granules / coated granules ≥ 5%
Control of 30/06/13	Bare granules / coated granules < 5%

The consistency of the coated granules was initially weak, afterwards sufficient.

Year 2014

From 3 numerical assessments (counting) performed on samples, the following ratio (%) emerged on bare granules with respect to coated granules:

Control of 01/04/14	Bare granules / coated granules ≤ 5%
Control of 30/04/14	Bare granules / coated granules < 5%
Control of 31/05/14	Bare granules / coated granules < 5%

Consistency of the coated granules sufficient, but with possibility of further improvement.

Out of these physical counting findings a progressive and significant improvement is evinced of the ratio between bare prilled urea granules and urelite granules (coated urea), in favour of the coated granules.
It has to be remembered that the bare prilled urea granules are useful for the immediate fertilization of the various crops, but being a low percentage (equal or lower than 5% of the total) they cannot provoke burnings at the plants themselves, as on the contrary often happens fertilizing only with a common urea.

3 CONCLUSIONS

From the biannual experimentation the following conclusions can be drawn:

a) Diameter of the granules:

The diameter of the URELITE® granules (coated prilled urea granules) has been regularised in the two experimentation years (2013 and 2014) standardising at an acceptable average both from a quantitative as from a qualitative point of view. The standard deviations (minus and plus variants) are mostly caused by matrixes of uneven value and by some aggregations between the granules themselves after coating; this phoenomena does not jeopardise the efficacy of URELITE®'s fertilizer's effect.

b) Ratio between the average weight of the bare prilled urea granules and the average weight of zeolitite mix coating of the granules:

In 2013 still criticalities were encountered together with some negative differences of weight disadvantaging the quantity of mixed zeolitite with respect to the weight of the prilled urea matrix, due to a loss of the zeolitic mix in powder, not well adhered to the granule.

During 2014 these criticalities were step by step overcome, until the product's features could be considered acceptable and stable (see the tables).
The same progress can be attributed to the consistency and cohesion (hardness) of the coated and dried granule.

The judgment on consistency can now be defined acceptable but susceptible to further improvements.

c) Regularity of the coating of the URELITE® granule:

A modest but significant improvement was obtained in the regularity of the coating of the prilled urea granule in 2014 with respect to 2013. The regularity of the coating has though a positive meaning from a commercial point of view, but less from the point of view of fertilizing efficacy of the product.

d) Ratio between the bare prilled urea granules and the coated granules (URELITE®):

The 2013 - 2014 trend has proven to be positive (see the tables), reaching values equal or inferior to 5%.