Handling, Treatment and Spreading of Pelleted Agricultural Wastes for Organic Fertilization

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1. Introduction

The solid/liquid separation generates one clarified fraction with good levels of NH_4^+ nitrogen and one nutrient-rich organic solid fraction for multiple uses.

Many studies have been carried out up to now on the optimization of the agricultural use of the liquid fraction (in particular with reference to NH_3 emission in atmosphere)

Little effort has been put in studying solutions aiming at optimizing the transport for the agronomic use of the solid fraction.

Pelletization as possible option

Pelletisation could effectively allow organic matter transport at further distance (even at hundreds km as order of magnitude) to move nitrogen from Nitrate Vulnerable Zones (NVZ) to others not vulnerable.

PELLETISATION

HOMOGENIZE

STANDARDIZE

CONCENTRATE

N removal from **N**itrate **V**ulnerable **Z**ones

2. Aim of the work

- ✓ Produce pellet from Swine Manure Solid Fraction (SMSF) added with different organic co-formulates.
- ✓ Highlight and compare - among them and among commercial products - the physical consequences of pelletisation on organic wastes, distributed by means of one rotating spreader.

3. Material and Methods

4 formulations were tested against **<u>2 commercial references</u>**

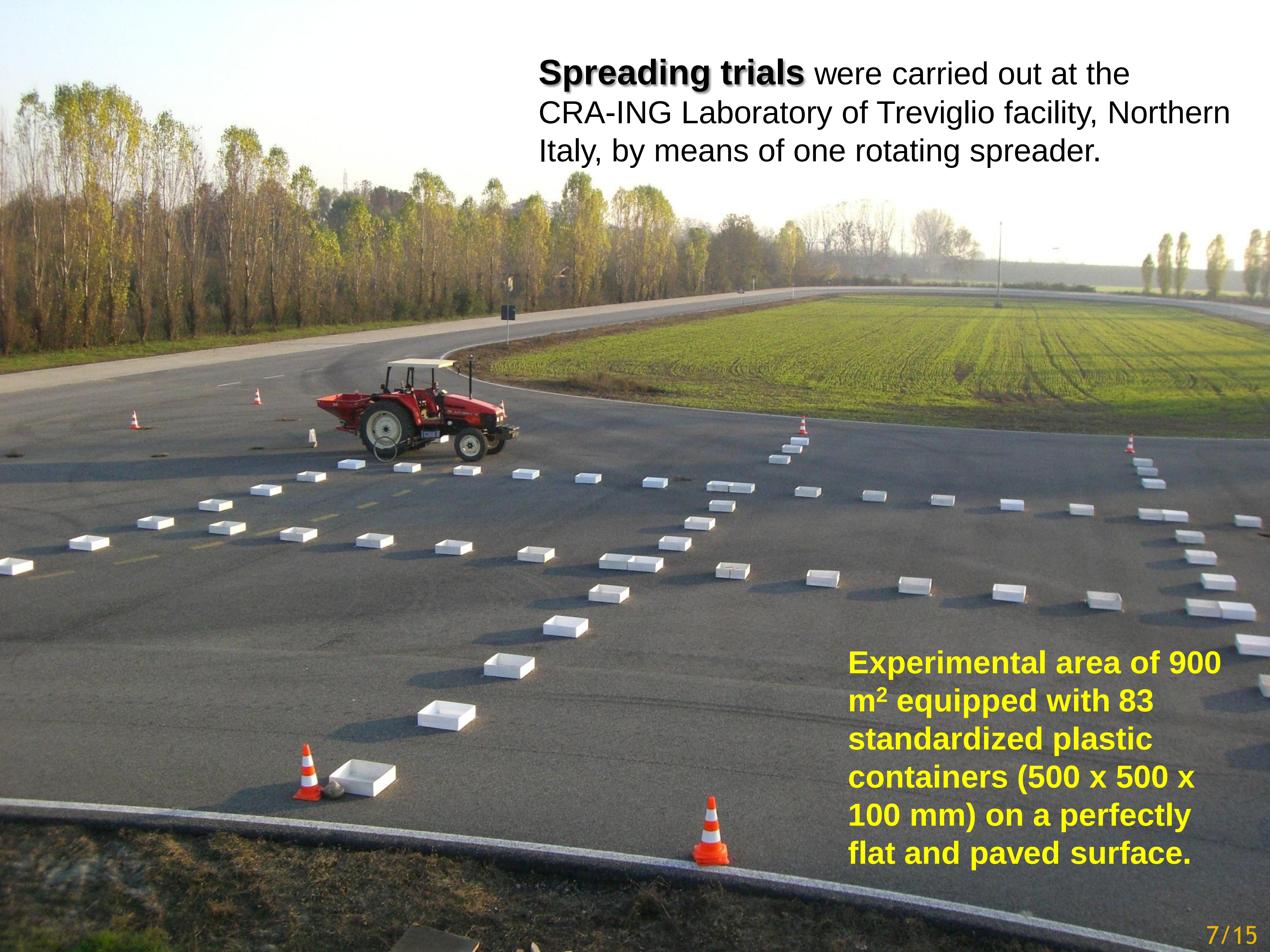
<u>Mechanical pelletizer</u>
model ***CLM200E***

Measurements

Each pellet type was physically characterized including the following aspects:

- Moisture content (% raw material)
- Weight by volume (g_{pellet} dm^{-3})
- Average length and diameter (mm)
- Pellet size distribution **before** and **after** the distribution
(% of three size fractions: "> *5mm*", "*5-2 mm*", "< *2 mm*")

Spreading trials were carried out at the CRA-ING Laboratory of Treviglio facility, Northern Italy, by means of one rotating spreader.



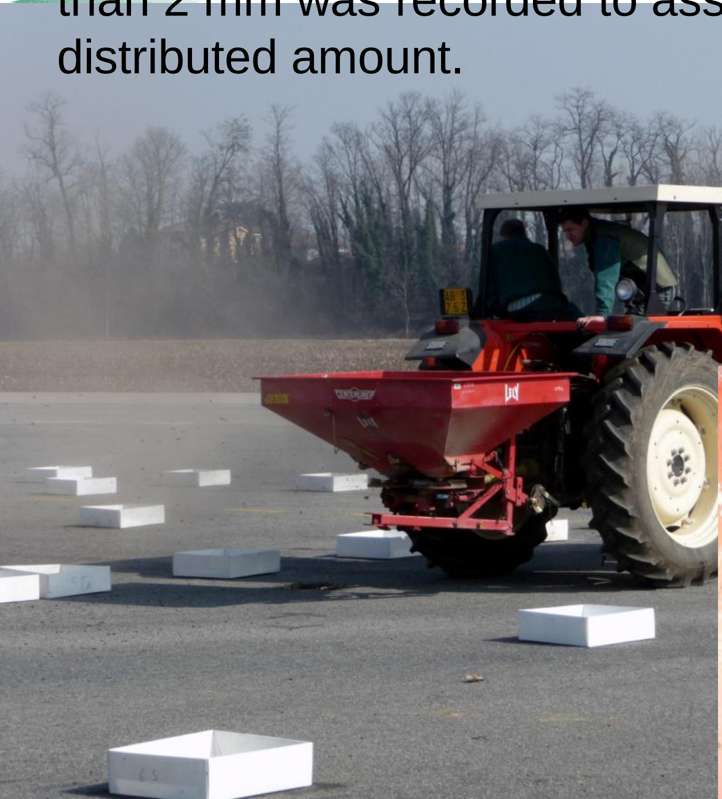
Experimental area of 900 m^2 equipped with 83 standardized plastic containers (500 x 500 x 100 mm) on a perfectly flat and paved surface.

Sample analysis

After each trial the amount of pelleted material captured by each container was weighed to draw distribution maps describing the pattern of the material thrown at different distances from the line of travel of the spreader.

European Standard EN 13080:2003 – Agricultural machinery – Manure spreaders – Environmental protection – Requirements and test methods

For each container, when present, the pelleted fraction whose diameter was less than 2 mm was recorded to assess the effect of the spreader on the quality of the distributed amount.



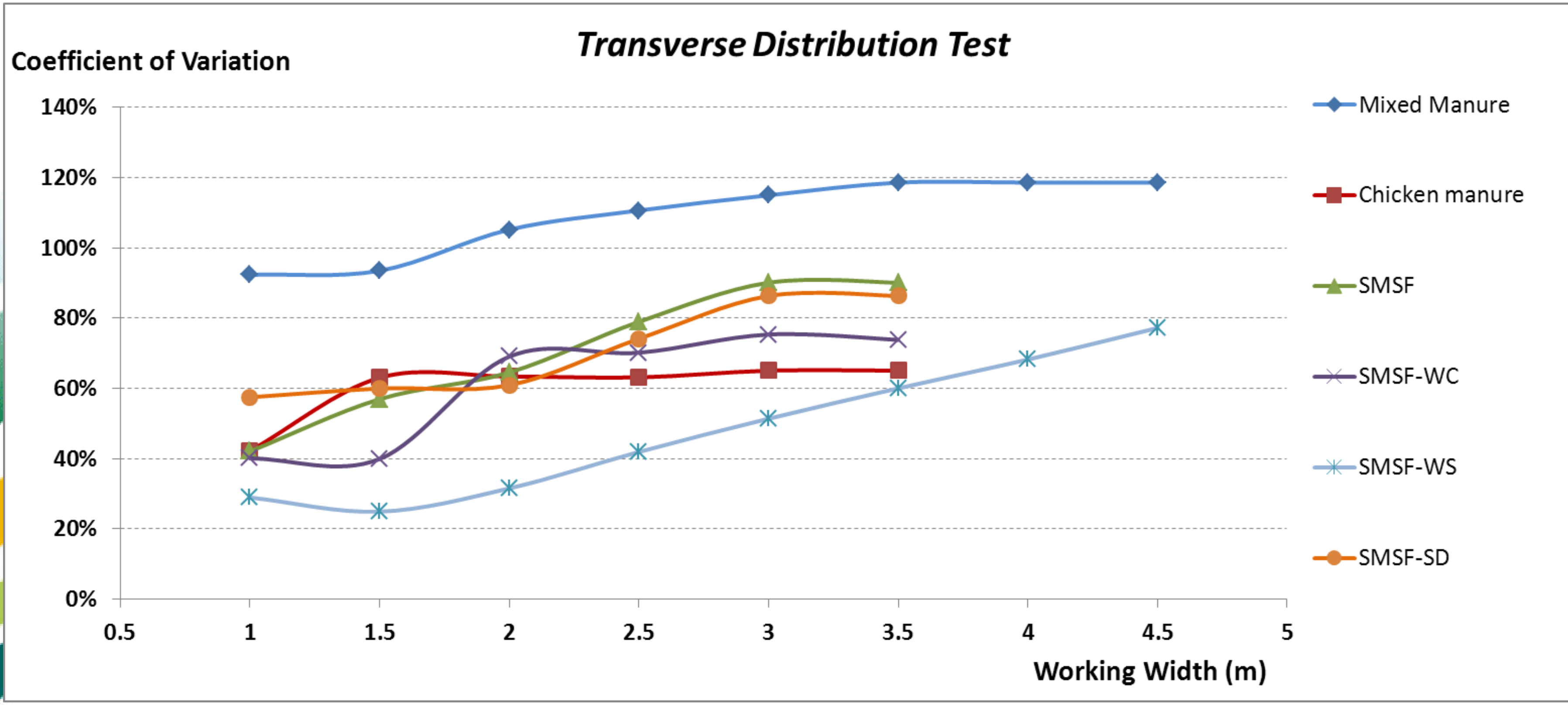
3. Results and Discussion

CHEMICAL & PHYSICAL PROPERTIES OF THE PRODUCED AND TESTED PELLED

Pellet Composition	Organic Matter (%)	TKN* (%)	C/N Ratio	Moisture at Spreading (%)	Pellet Length (mm)	Pellet Diameter (mm)	Volume Weight (g dm^{-3})
SMSF	47.0	1.3	23.1	12.5 ± 0.38 (a)	13.1 ± 3.35 (a, b, c)	5.51 ± 0.52 (a)	669.8 ± 15.7 (a, b)
SMSF -SD	38.6	1.9	12.1	9.06 ± 0.31 (b)	13.9 ± 3.29 (a, b, c)	5.48 ± 0.48 (a, b)	701.1 ± 13.4 (b)
SMSF-WC	44.5	0.9	13.8	5.14 ± 0.57 (c)	14.6 ± 4.17 (a, b, c)	5.35 ± 0.46 (b, c)	312.2 ± 51.4 (c)
SMSF-WS	44.5	0.6	14.6	4.18 ± 0.11 (c)	30.2 ± 9.57 (e)	5.91 ± 0.22 (d)	632.7 ± 24.1 (a, c)
Mixed Manure	64.6	2.8	13.6	12.5 ± 0.12 (a)	11.8 ± 3.03 (a, b)	4.05 ± 0.27 (e)	595.8 ± 2.69 (c)
Chicken Manure	70.7	4.0	10.2	10.5 ± 0.75 (d)	15.0 ± 4.88 (b, c, d)	3.94 ± 0.15 (e)	543.8 ± 27.3 (d)

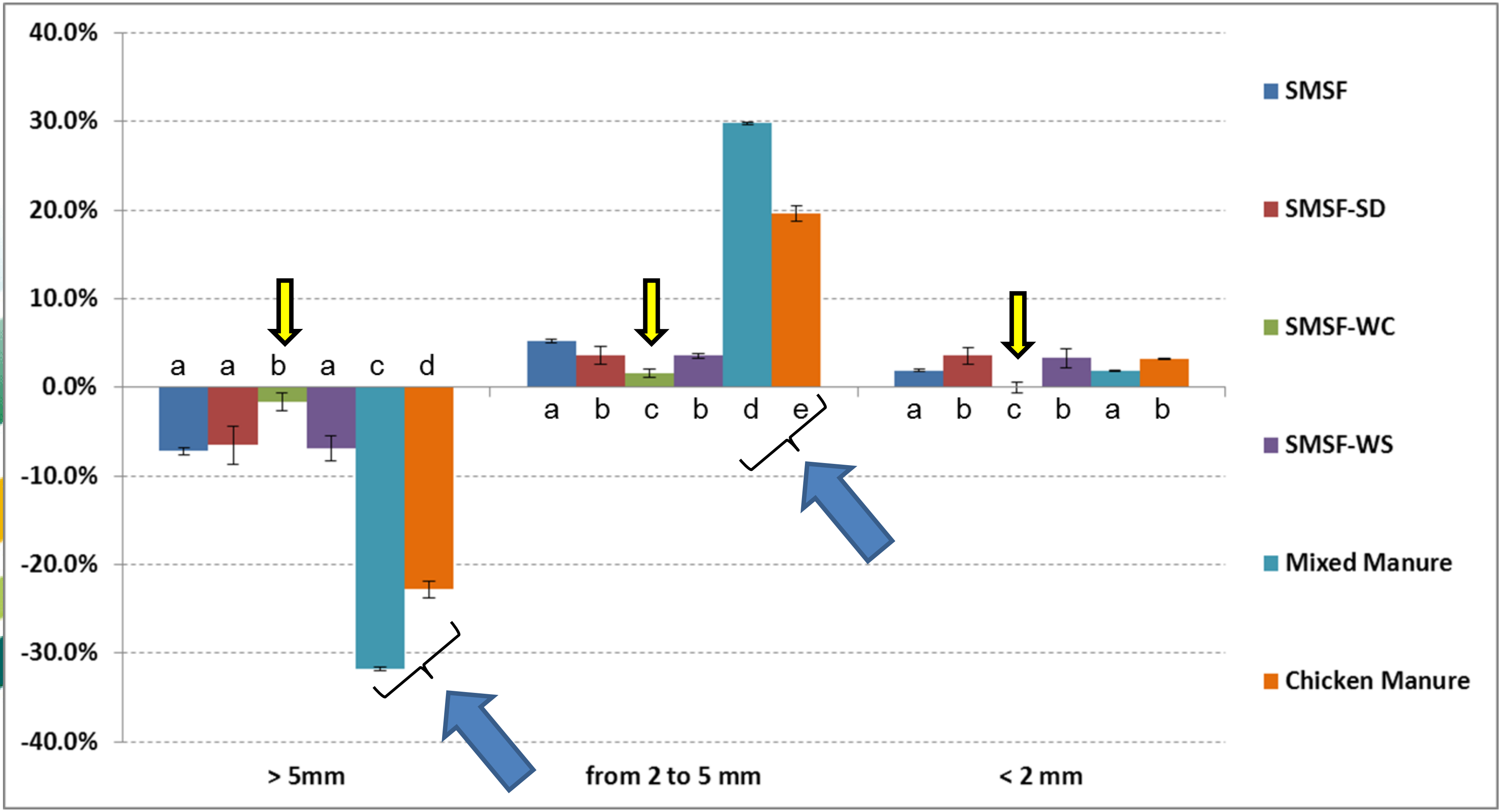
*Total Kjeldahl Nitrogen

Transverse distribution (according to EN 13080:2003)



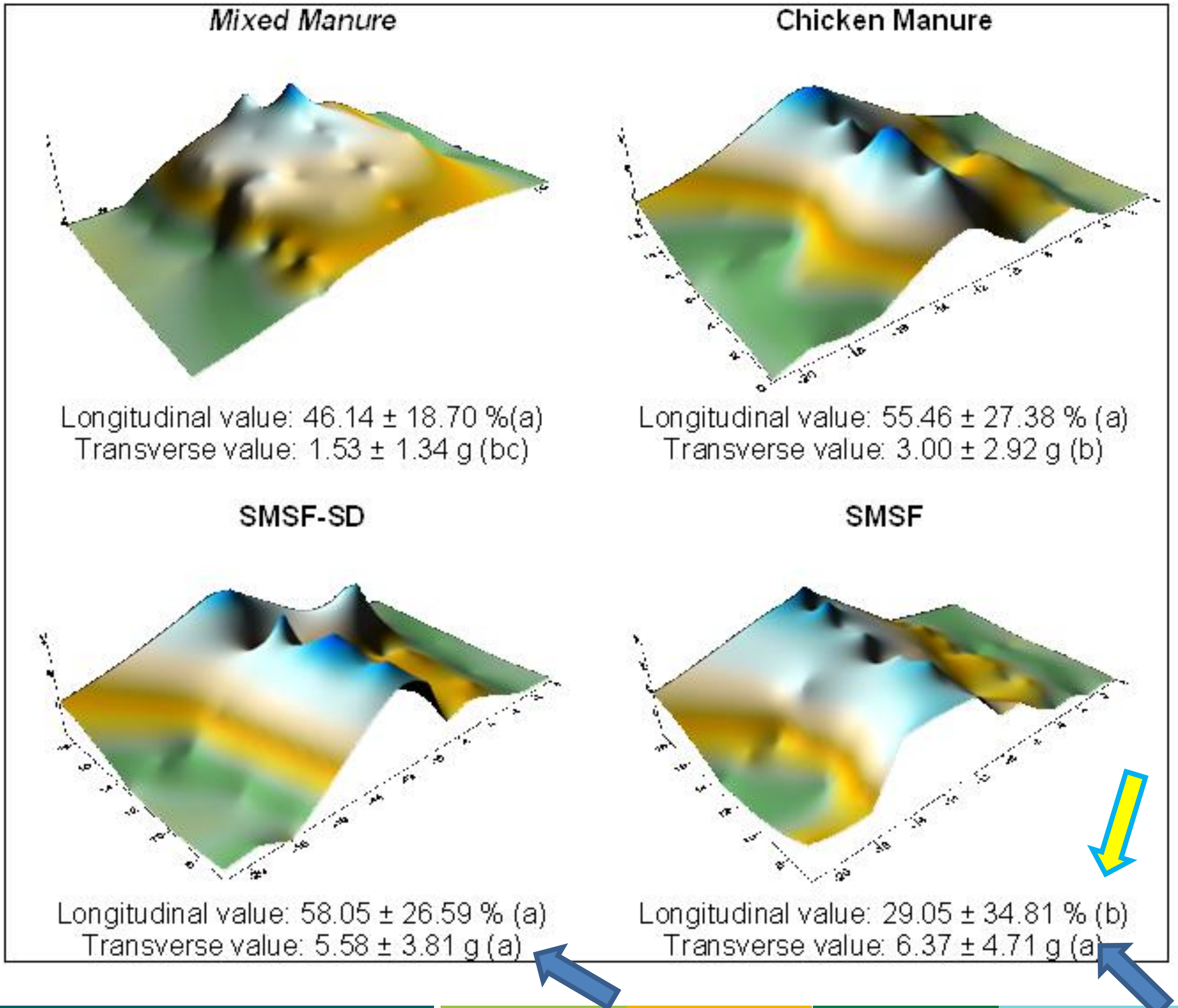
The different formulations hardly ever could be differentiated by means of their CV%

Changes in pellet size distribution as consequence of the spreading



Longitudinal and transverse distribution patterns of SMSF-SD, SMSF, “Mixed Manure” and “Chicken manure”

Pellet formulation greatly influenced (P<0.001) the longitudinal distribution



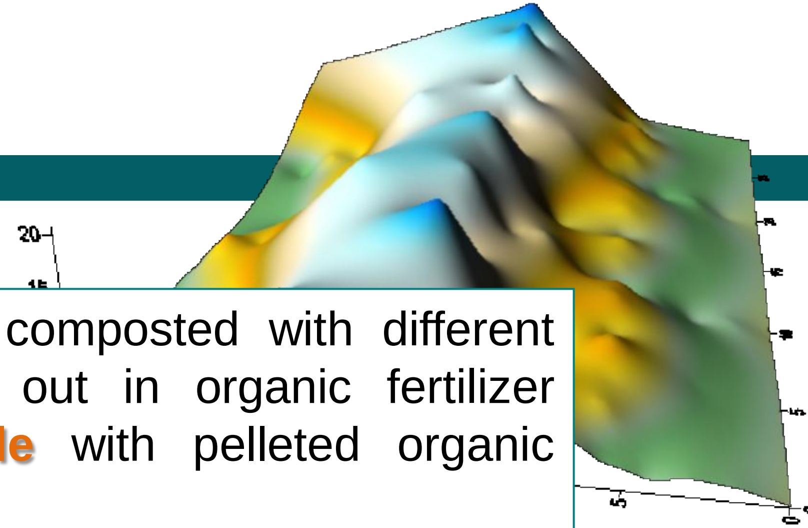
4. Discussion

The practical significance of this collection rates related to the maximum collected is that as long as the tractor advances, formulations with higher collection rates affect the characteristic flow of the spreader tending to empty the hopper more slowly than those showing lower collection rates.

Transverse distribution collection rates did not show any significant difference of pellet formulation, hence the attention was driven to the amount of pellet collected by each container.

Here, high significant influence was found for pellet formulation and container position with reference to spreader (both at $P<0.001$).

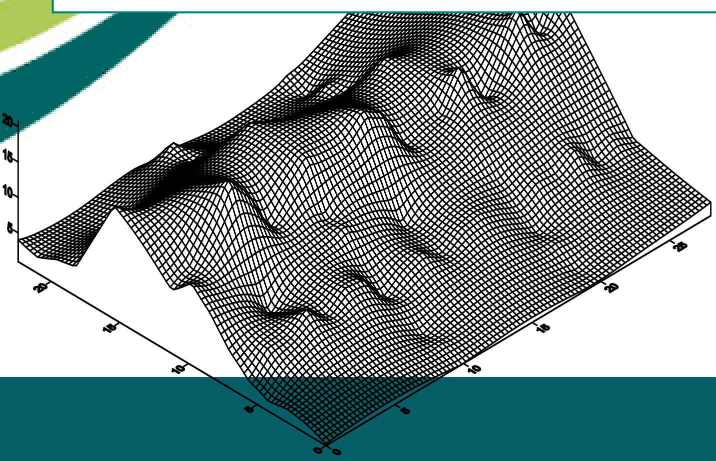
5. Conclusions

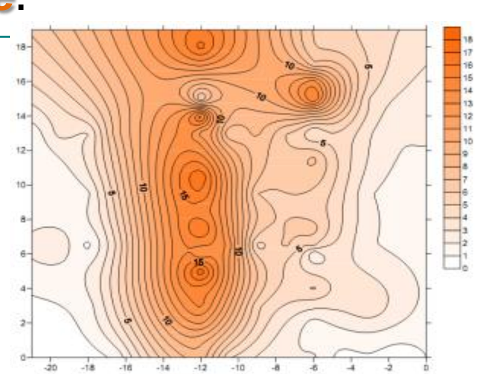


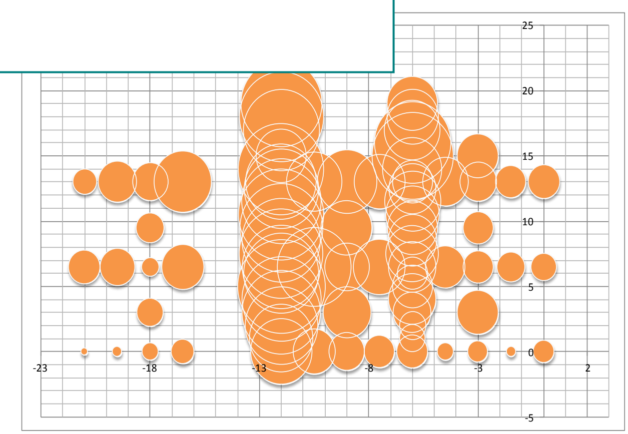
- Results show that pelletisation of SMSF composted with different organic materials as co-formulates can turn out in organic fertilizer formulations that are **technically comparable** with pelleted organic fertilizers ordinarily available on the market.

- In particular **SMSF-SD**, was the formulation showing **the best longitudinal and transverse distribution** while SMSF was the one showing good transverse but poor longitudinal distribution.

- Further studies are still required to better verify the compliance of these products with law requirements, the level of appreciation of the users as well as their **agronomic value**.







Thank you for your attention

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