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Dr. Sugeng Triyono

University of Lampung, Indonesia

*Effect of water content and NPK enrichment
on some properties of a pelletized compost fertilizer*

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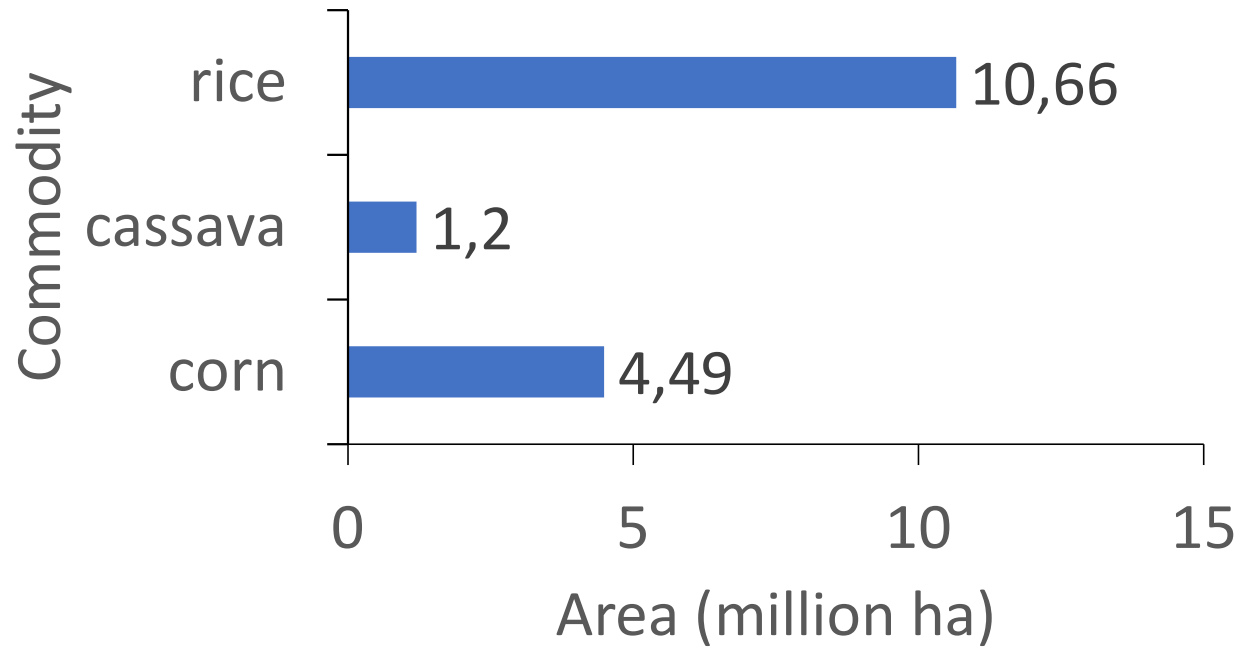
Dr. Andrey Kuzmin

EFFECT OF WATER CONTENT AND NPK ENRICHMENT ON SOME PROPERTIES OF A PELLETIZED COMPOST FERTILIZER

**Sugeng Triyono^{1*}, Agus Haryanto¹, Elhamida Rezkia¹,
Diannisa Widdi Eka Ningrum¹, Dermiyati²**

^{1,2}) University of Lampung, Bandar Lampung, Indonesia

Background



total Fertilizer applied = 8.175.000 ton/season

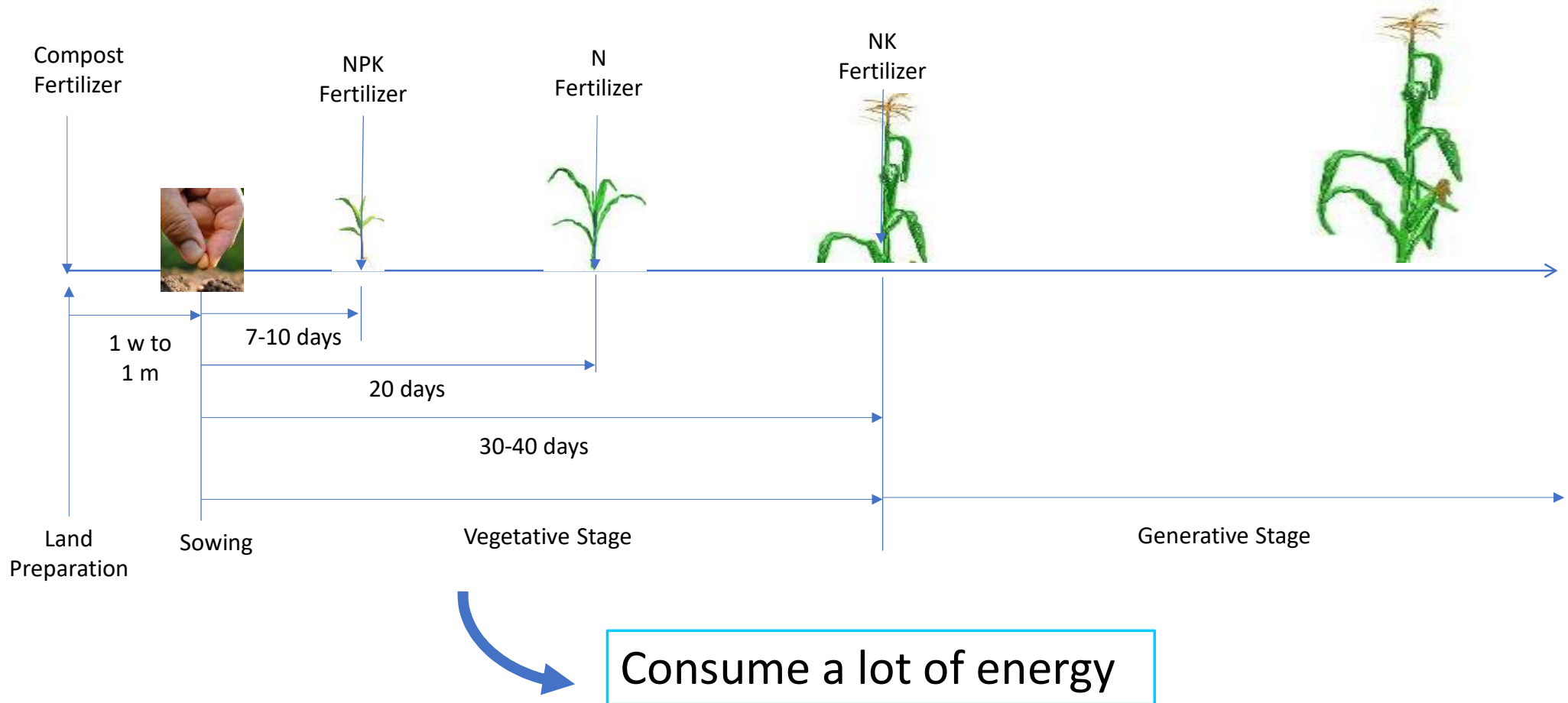
Problems Associated with Fertilizer Application

1. Farmers sow fertilizer on the soil surface



Susceptible to leaching

2. Fertilizer Applied in more than 1 time



3 Farmers are reluctance to use organic or compost fertilizers for some reasons



- Compost is bulky. Complicated in handling

Chemical Content of Compost	%
C	16,11
N	1,26
P	3,04
K	0,42

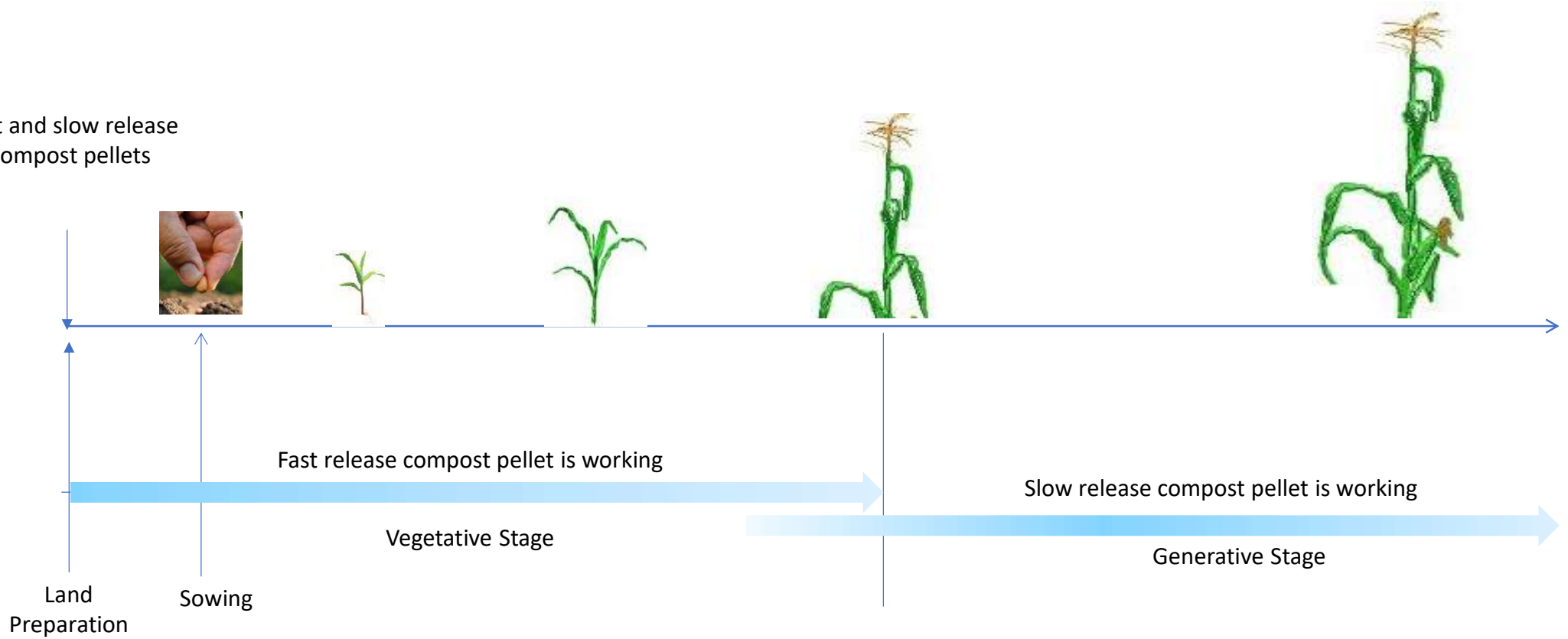
- Low macronutrient especially N, P, K. Not enough to support fruiting crops

Proposed Ideas

- Compost fertilizer may need to be compacted or pelletized
- Compost fertilizer may need to be enriched with inorganic NPK fertilizer
- Compost fertilizer pellets may have to have different solubility (Fast and Slow Releases). So fertilizer application may be just ones in advance, for the whole lifecycle of plants

HOW COMPOST PELLETS WORK

Fast and slow release
compost pellets



Objectives of this research were:

- To evaluate the effects of water content and NPK addition doses on some properties of pelletized compost fertilizer with high and low solubilities.

MATERIALS AND METHODS

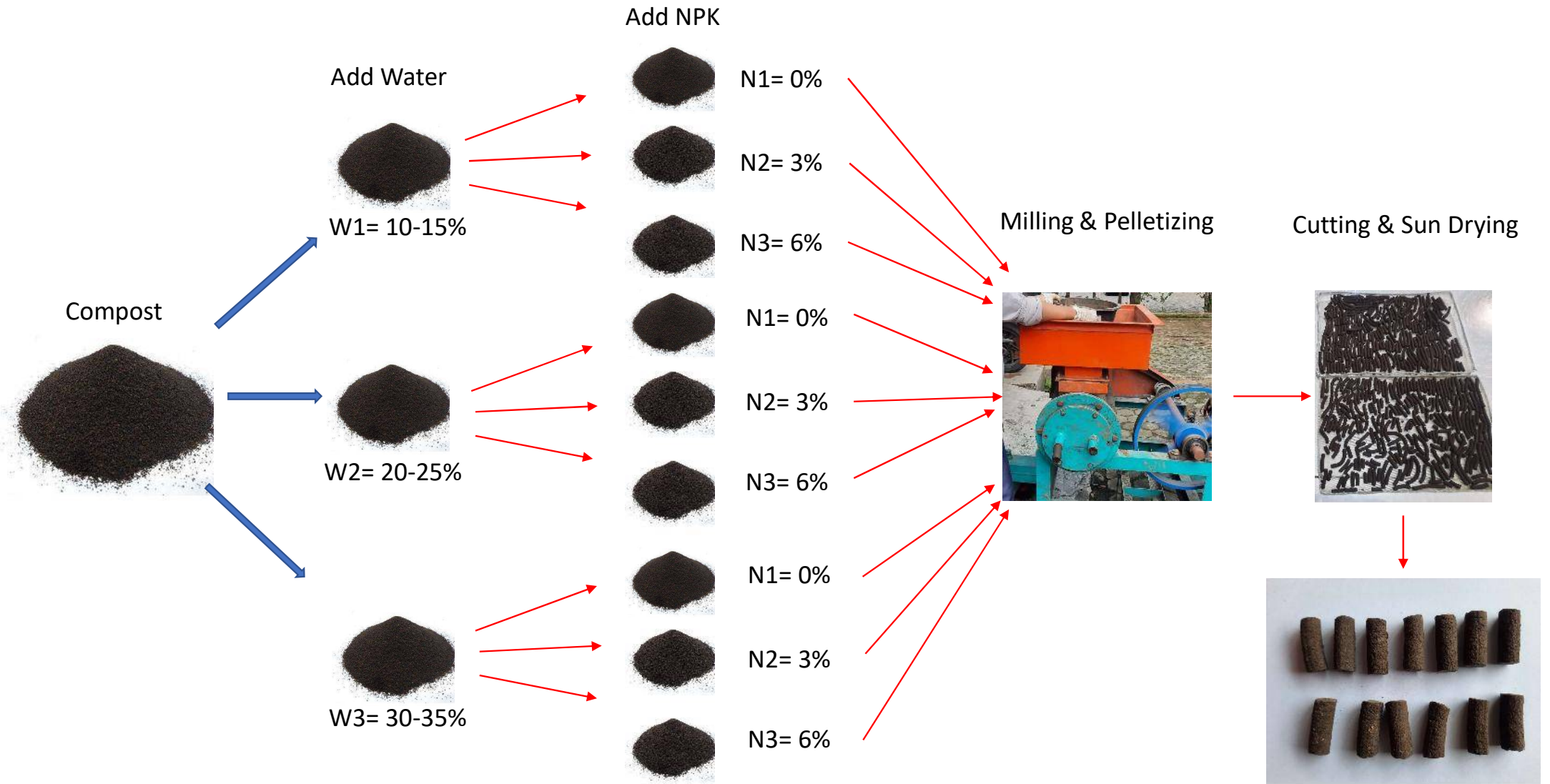
Compost Materials

Materials	Volume (Liter)	Bulk Density (g/lt)	Fresh Weight		Water Content (%)	Dry Weight	
			(kg)	(%)		(kg)	(%)
Spent Mushroom Substrate	50	300.22	15.01	38.38	41.63	5.24	30.27
Cattle Manure	30	536.00	16.08	41.11	54.70	7.28	42.06
Chicken Litter	5	493.00	2.48	6.34	14.45	2.12	12.25
Cocopeat	5	256.00	1.28	3.22	80.63	0.24	6.99
Rice husk ash	5	252.00	1.26	7.67	3.26	1.21	7.05
MSG Industry sludge waste	5	600.00	3.00	3.27	59.03	1.22	1.39
Total	100	391.10	39.11	100.00	21.08	17.31	100.00

Chemical properties of Compost Materials

Raw Materials	WC (%)	Org C (%)	Total N (%)	C-N Ratio	Total P (%)	Total K (%)
Spent Mushroom Substrate	41.60	46.67	1.29	36.18	0.14	2.50
Cattle Manure	70.00	22.71	1.47	15.45	1.93	1.16
Chicken Litter	19.54	44.67	0.56	79.77	0.27	0.77
Cocopeat	55.00	22.34	2.26	9.88	0.54	0.46
Rice husk ash	9.02	51.34	-	-	-	-
MSG Industry sludge waste	20.00	-	-	-	21.74	-

Compost Pelletization

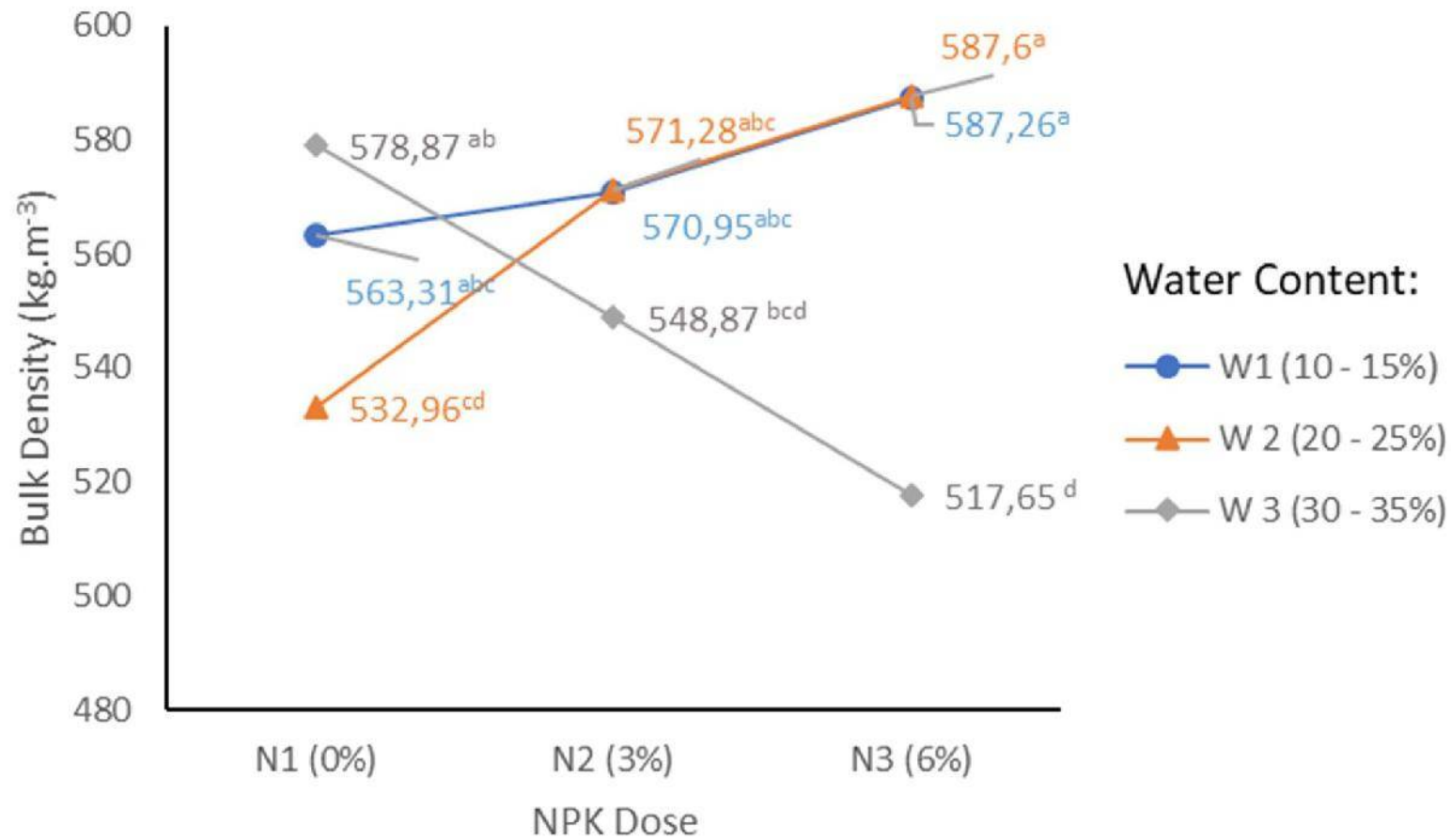


Experimental Design and Parameter Testing

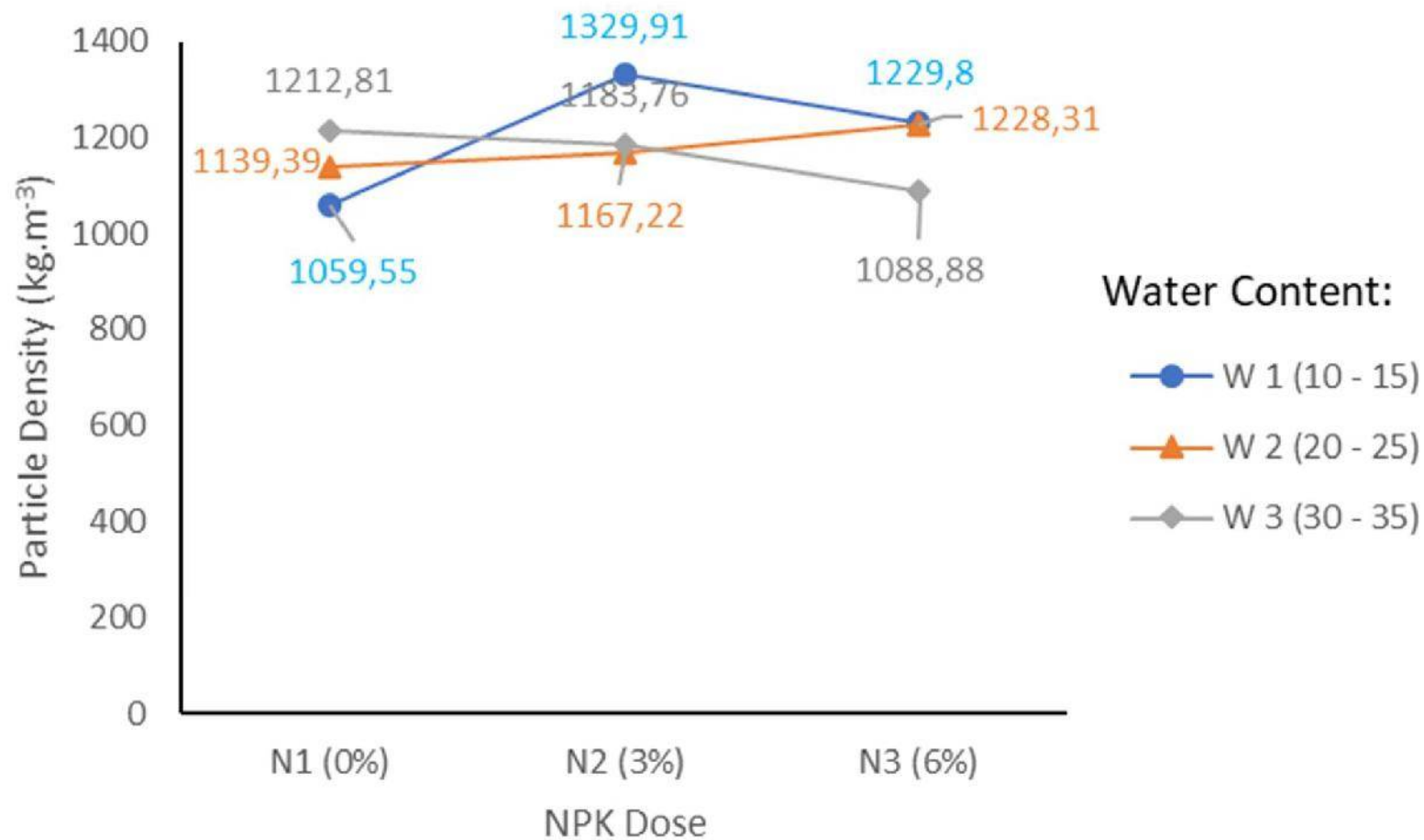
- Parameter Testing & Measurement followed Completely Randomized Design (CRD), with factorial arrangement. First factor was water content (W) and second factor was NPK addition doses.
- 9 treatment combinations of Water content & NPK addition doses, each was sampled with 3 replicates for every parameter testing & measurement.
- Parameters included: Bulk density, particle density, hygroscopicity, compressive strength, Impact strength, Vibration strength, pH, and Solubility

RESULTS AND DISCUSSIONS

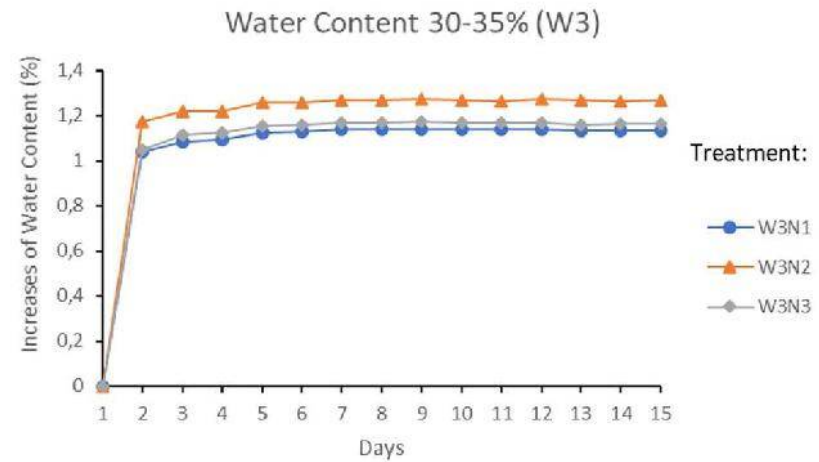
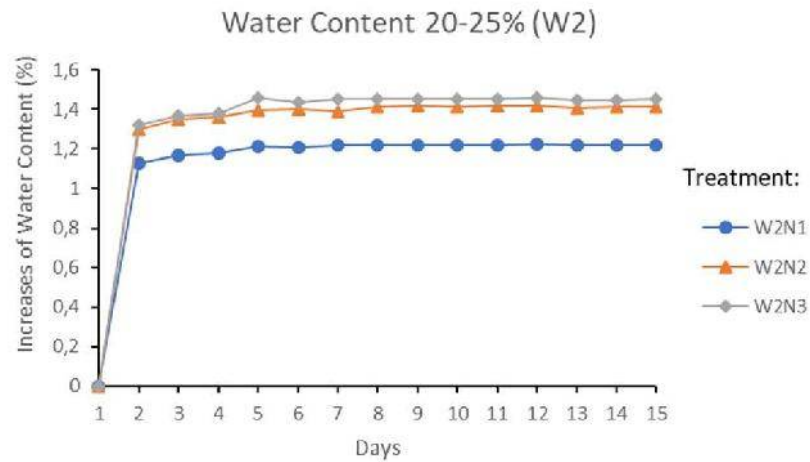
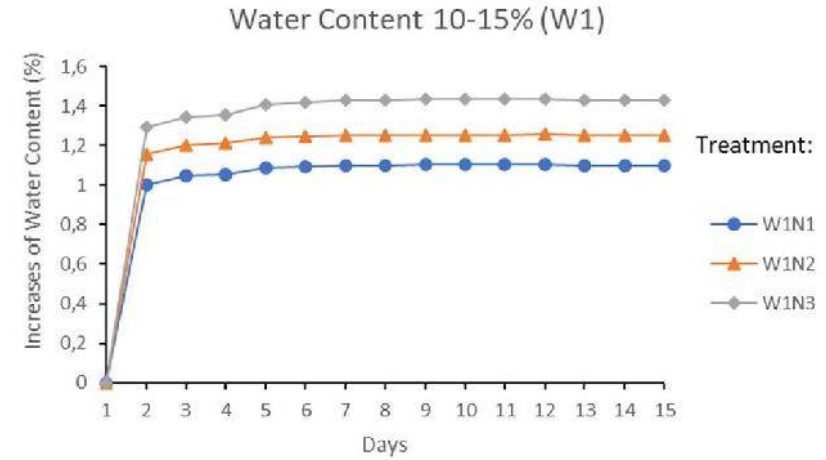
Effect of water content & NPK dose on bulk density of pellet



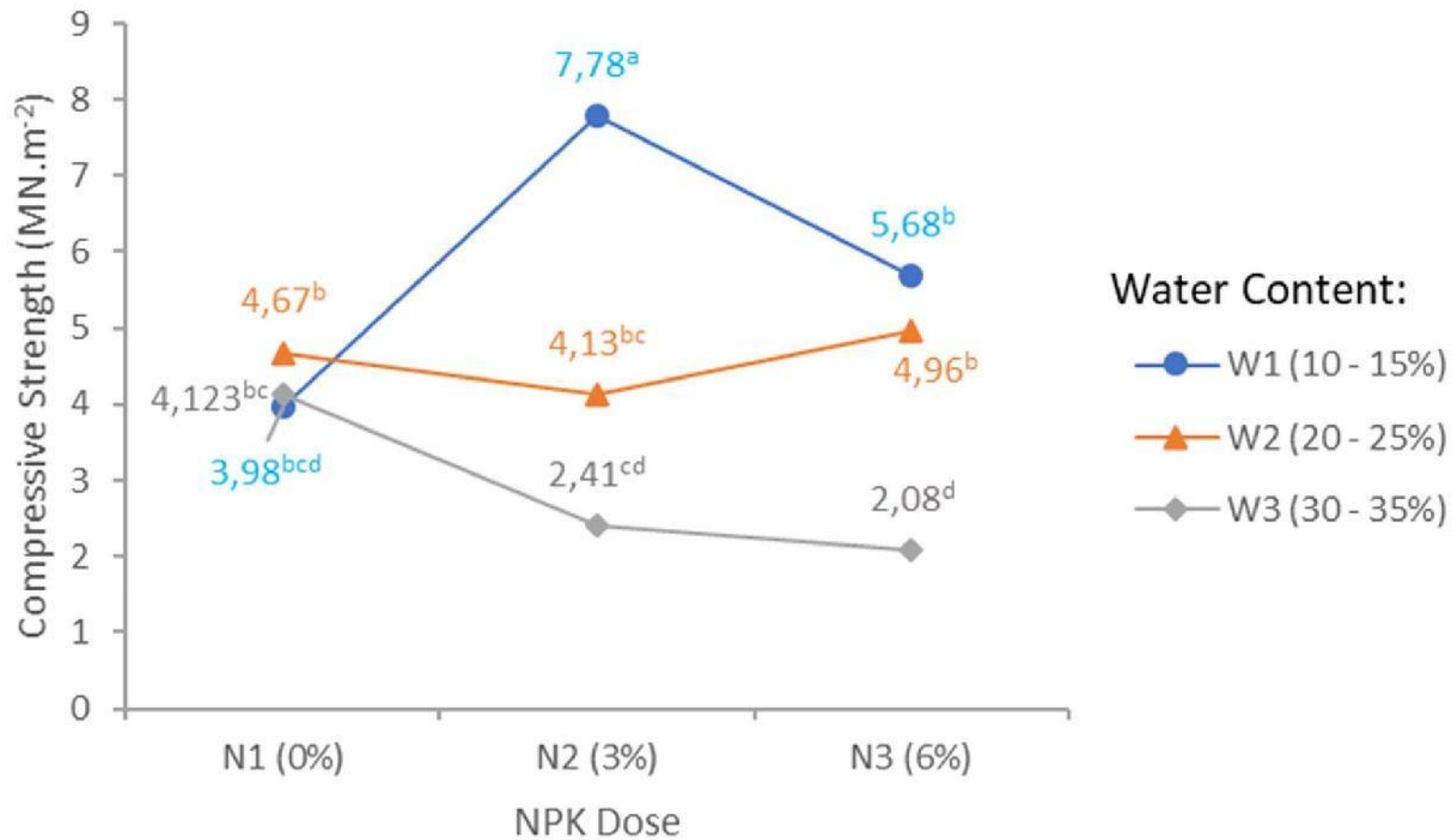
Effect of water content & NPK dose on particle density of pellet



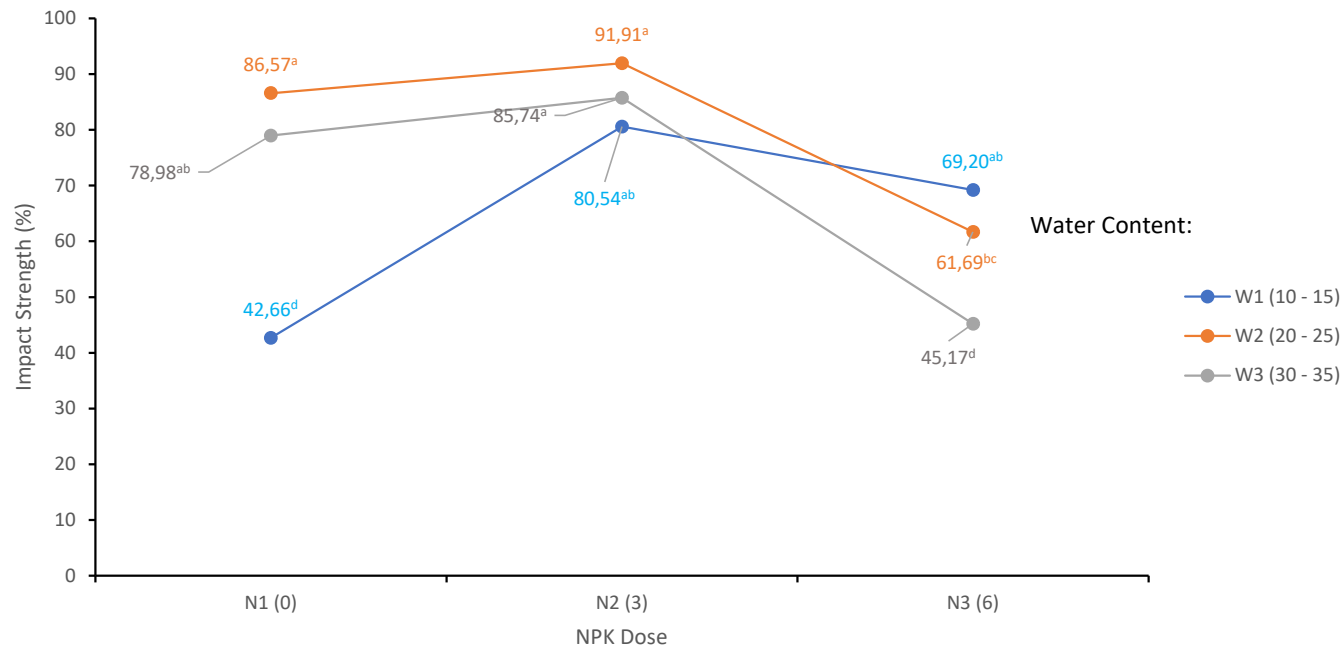
Moisture absorption at 28°C and 80% RH



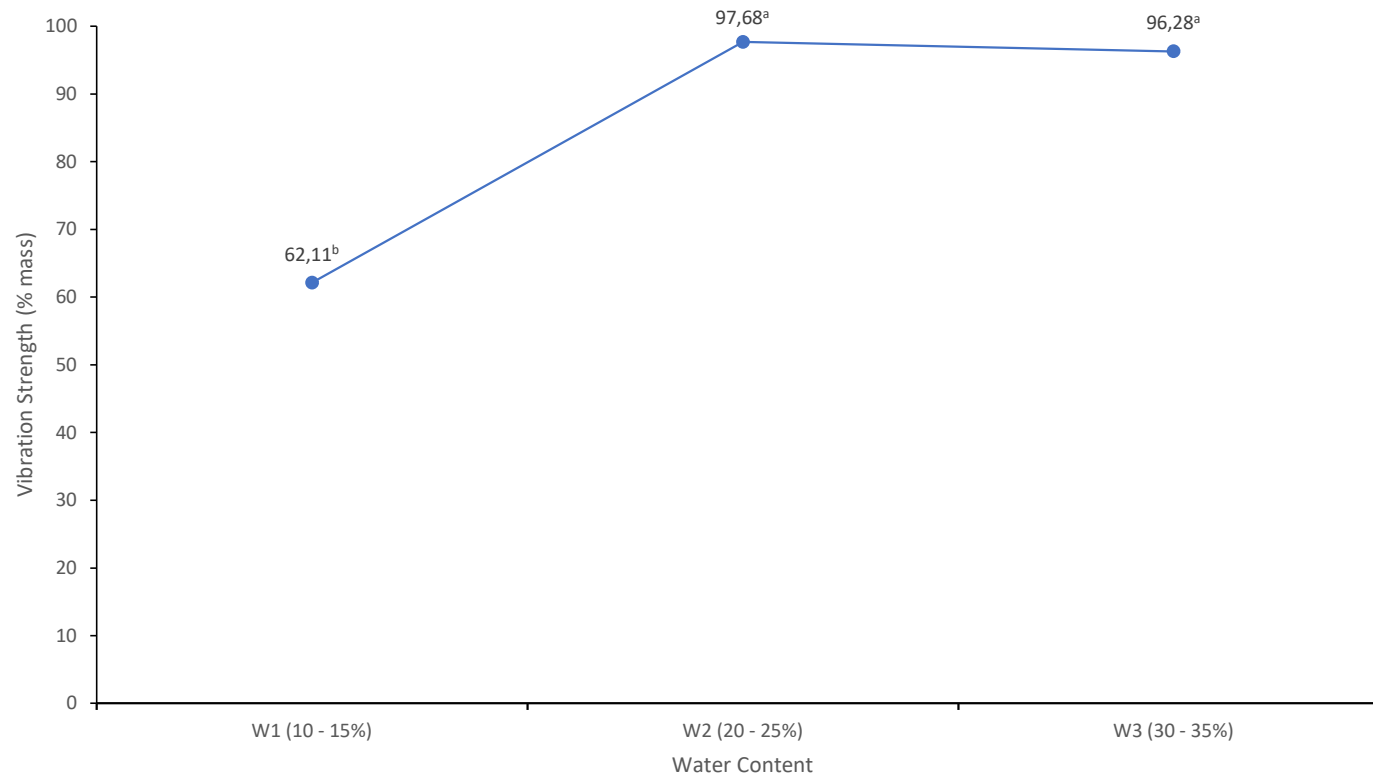
Effect of Water Content & NPK Dose on Compressive Strength of the Pellet



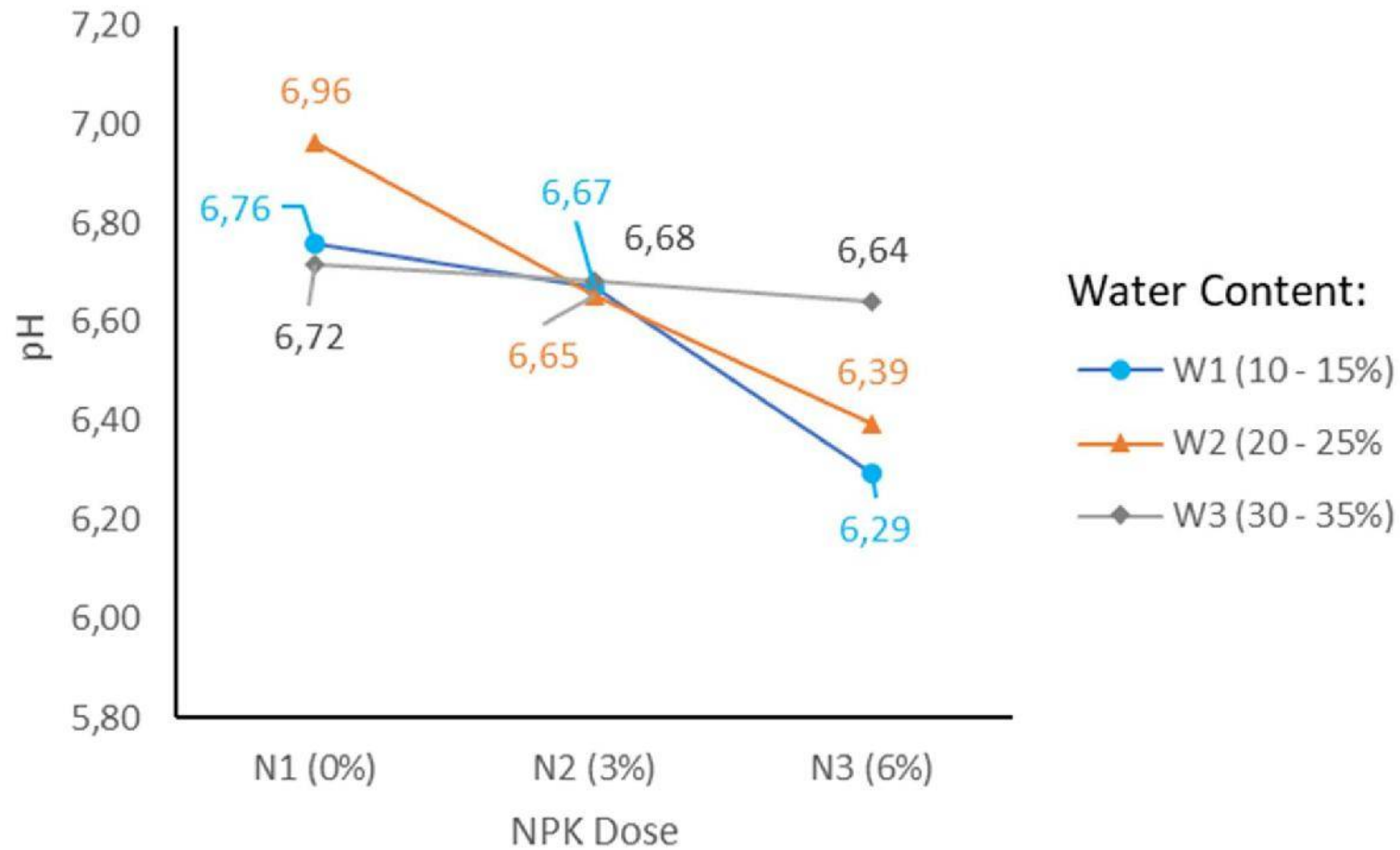
Effect of Water Content & NPK Dose on Impact Strength (%mass) of Pellet



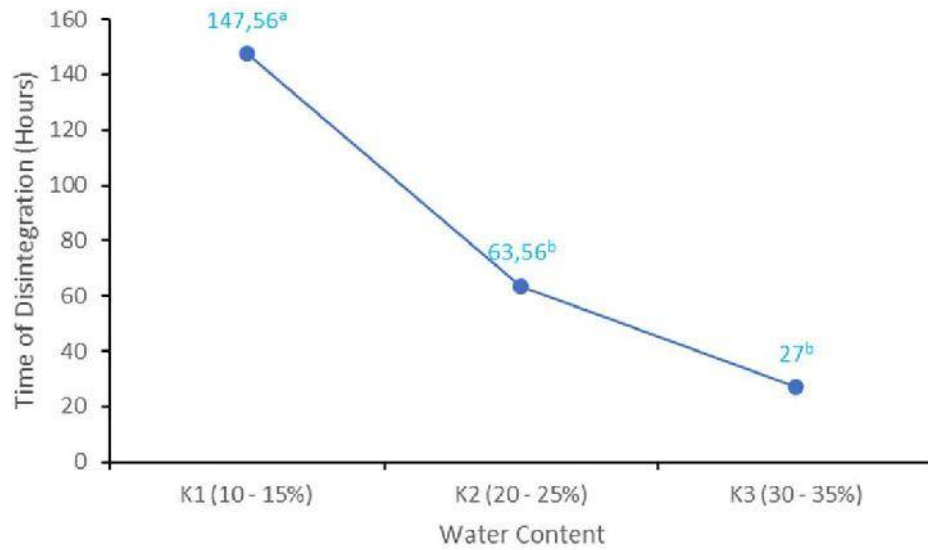
Effect of Water Content & NPK Dose on Vibration Strength (%mass)



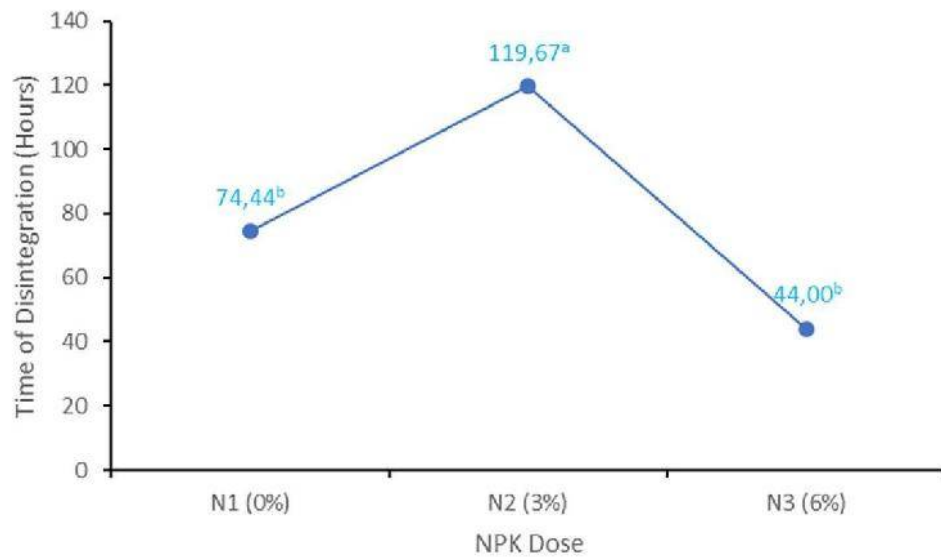
Effect of Water Content & NPK Dose on pH



Effect of Water Content on Solubility of Pellet



Effect of NPK Dose on Solubility of Pellet



SUMMARY

Selection of the Treatment to produce Slow Release Compost Pellet

Parameters	W Faktor	NPK Faktor	Interaction	Best Treatment
Objective Parameter:				
Low Solubility	W1	N2	ns	W1N2 (Slow Release Pellet)
Properties:				
Bulk Density	ns	ns	s	W1N1, W3N1, W1N2, W2N2, W1N3, W2N3
Particle Density	ns	ns	s	W3N1, W1N2, W3N2, W1N3, W2N3
Compressive Strength	s	ns	s	K1N2
Impact Strength	ns	s	s	W2N1, W3N1, W1N2, W2N2, W3N2, W1N3
Vibration Strength	W2, W3	ns	ns	-
Low Higoscopisity	ns	ns	ns	-
pH	s	s	s	all values arround 7 (6.29-6.896)

Selection of the Treatment to Produce Fast Release Compost Pellet

Parameter	W Faktor	N Faktor	Interaksi	Best Treatment
Objective Parameter:				
High Solubility	W2, W3	N1, N3	ns	W2N3, W3N1 (Fast Release Pellet) W2N1, W3N3
Properties:				
Bulk Density	ns	ns	s	W1N1, W3N1, W1N2, W2N2, W1N3, W2N3
Particle Density	ns	ns	s	W3N1, W1N2, W3N2, W1N3, W2N3
Compressive Strength	s	ns	s	W1N2 (best), W2N3 and W3N1 (second best)
Impact Strength	ns	s	s	W2N1, W3N1, W1N2, W2N2, W3N2, W1N3 W2N3 (second best)
Vibration Strength	W2, W3	ns	ns	W2, W3 best
Hygrosopicity	ns	ns	ns	All the same
pH	s	s	s	all arround 7 (6.29-6.896)

CONCLUSIONS

- Water content and NPK doses affected some properties of the compost fertilizer pellet
- Slow release pellet was found in the treatment of WIN2 (water content of 10-15% and NPK dose of 3%)
- Fast release pellets were found at the treatment of W2N3 (Water content of 20-25% and NPK of 6%) and W3N1 (Water content of 30-35% and NPK of 0%).

ACKNOWLEDGEMENT

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Thank You