PHILIPPINE NATIONAL STANDARD

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ICS 65.080

Organic fertilizer

BUREAU OF PRODUCT STANDARDS

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Contents **Page**

Foreword

This Philippine National Standard for Organic Fertilizer was prepared with substantial inputs from the Fertilizer and Pesticide Authority's (FPA) existing regulations (please see reference) by the Technical Working Group (TWG) of the Bureau of Agriculture and Fisheries Product Standards (BAFPS) created per Special Order No. 565 series of 2004 dated 02 December 2004, reviewed and presented for public consultation in Davao City, Bacolod City and Puerto Princesa City. Likewise, this standard was posted in the BAFPS website (http://www.bafps.da.gov.ph) wherein various comments from the stakeholders were carefully evaluated and inputted accordingly in the draft.

This was formulated to further improve and ensure consistent quality of organic fertilizers available in the Philippine market.

This standard cancels and replaces PNS 928:1995.

1 Scope

This standard applies to organic fertilizer in its primary *(humus)* form.

2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3 Definitions

For the purpose of this standard, the following definitions apply:

3.1 General

3.1.1
organic fertilizer
any product of plant or animal origin that has undergone substantial decomposition either through natural or accelerated processes through the application of microbial inoculants where the original materials are no longer recognizable, free from any pathogens, soil-like in texture, contains not less than 20 % organic matter (o.m.), and can supply nutrients to plants

3.1.2
pure organic fertilizer
an organic fertilizer material or any substantially decomposed product of plant or animal origin which was not enriched with chemical ingredients to increase its nutrient content with minimum total NPK of 1.5 %

3.1.3
organic matter
any material that originated from living organisms

3.1.4
microbial inoculants
biologically active products containing optimum population of one or a combination of active strains of beneficial bacteria, actinomycetes, enzymes, algae and fungi that are useful in different biological activities, such as N_2fixation, accelerated decomposition of organic residues and solubilization/concentration of a specific element from the soil for faster nutrient absorption by the plant

3.1.5
humus
that stable fraction of organic matter after a major portion of plant and animal residues have decomposed, usually amorphous and dark in color.

3.1.6
pathogens
organisms causing diseases of man, animals and crops

3.1.7
plant micronutrients
group of nutrients, which are essential for plant growth but are required in small amounts (less than 1 ppm in plants). These include readily available forms of iron, manganese, boron, molybdenum, copper, zinc, chlorine, and cobalt

3.1.8
plant macronutrients
group of nutrients needed by plants in large amounts (usually greater than 1 ppm in plants). This can be applied artificially in fertilizer

3.1.9
compost
any product of plant or animal origin that has undergone substantial decomposition through natural processes or accelerated with the use of microbial inoculants and/or proper C:N ratio of substrates where traces of the original materials are still recognizable, maybe partly soil-like in texture, and can supply nutrients to plants

3.1.10
bio-organic fertilizer
an organic fertilizer material of fully decomposed product of plant or animal origin which is fortified with beneficial microbes and enzymes to eliminate pathogens, render inert foreign impurities such as pharmaceuticals and antibiotics, and improve the availability of the material's macro and micronutrient contents for faster absorption by the plant

3.1.11
treated animal manure (TAM)
a bio-organic fertilizer made from pure animal manure treated with microbial inoculants to kill pathogenic bacteria and render inert pharmaceuticals and antibiotics ingested by the fowl, through a hastened fermentation and decomposition process and enriched with beneficial microbes and enzymes to help release the manure's full macro and micronutrient contents for faster absorption by the plant

4 Classification

There shall only be one classification of organic fertilizer:

4.1 Pure Organic Fertilizer

5 Requirements

5.1 General

Organic fertilizer must conform to the requirements specified in this standard.

5.2 Physical

An organic fertilizer must be substantially decomposed as evidenced by the following characteristics:

5.2.1 Material

The original materials are biodegradable.

5.2.2 Color

Color is from brown to black.

5.2.3 Texture

Must be friable soil-like texture.

5.2.4 Moisture Content

Must not exceed 30 %.

5.2.5 Odor

Must emit the completely decomposed substrate.

5.2.5.1 pure organic fertilizer

Must not emit the original or partially decomposed substrate.

5.2.6 Organic matter

must at least be 20 %

5.2.7 Carbon nitrogen ratio

C:N ratio must not be higher than 15:1.

5.2.8 Temperature

The temperature of the product must not be higher than 30 ^{o}C.

5.2.9 Germination test

The product shall show a % seed germination higher or equal with the control or checkplant.

5.3 Nutrient Content

Nutrient content is specified as:

5.3.1 Specifications of pure/fortified organic fertilizer

Specification	Level
Total NPK	1.5% min
C:N	15:1
Moisture content	≤ 30 %
Organic matter	≥ 20 %

5.4 Test for pathogens for organic fertilizer

Organic fertilizer must be free of pathogens (man, animals/livestock & crops).

5.4.1

Specification	Level
Fecal streptococci	< 5 x 10^2 colonies/g
Total coliforms	< 5 x 10^2 colonies/g
Salmonella	0
Infective parasites	0

5.5 Allowable level of heavy metals in organic fertilizer

5.5.1

Heavy metal	Maximum allowable level in compost (mg/kg dry weight)
Pb	750 - 500
Hg	5
Cd	5
As	5
Cu	300
Cr	150
Ni	50
Zn	50
Euro - BSWM	

5.6 Presence of weed seeds

Seeds may be present but no viable weed seeds must be present.

5.7 Absence of Foreign Materials

Plastics, aluminum wrappers, stones and other inert materials must be totally removed from the product.

6 Sampling

Organic fertilizer must be sampled in accordance with PNS 85.

7 Test Methods

Testing is made in accordance with the following methods:

7.1 Moisture and volatile content – Annex A;

7.2 Organic matter – Annex B;

7.3 Organic carbon – Annex B;

7.4 Germination test – Annex C; and

7.5 Total nitrogen – Annex D.

8 Packaging

8.1 Material

Organic fertilizer weighing more than 5 kg must be packed in woven polypropylene sack conforming to PNS 95 with polyethylene liner while those weighing 5 kg or less must be packed in polyethylene bag with a suitable thickness to afford maximum protection from normal hazard of transportation and handling.

8.2 Sizes

Organic fertilizer is packed with a tolerance of ±0.4 % as shown below:

8.2.1

Mass, net weight (kg)	Allowed variance (Tolerance), in grams
50	± 200
25	± 100
10	± 40
5	± 20
1	± 4

9 Marking and labelling

Information must be legibly and indelibly printed on the bag in conformity to PNS 1033:

9.1 Left panel

9.1.1 Manufacturer/distributor, name and address

9.1.2 Date of formulation

Lot no._____

9.1.3 Color band – violet-purple

9.2 Front

9.2.1 Name of material (Pure or Fortified organic fertilizer),

Trade name or brand name

9.2.2 Guaranteed analysis

9.2.2.1 Total N (%)

Ammoniacal nitrogen (%)
Nitrate nitrogen (%)

9.2.2.2 Total P_2O_5 (%)

Available P_2O_5 (%)

9.2.2.3 Total K_2O (%)

Water-soluble K_2O (%)

9.2.2.4 C:N ratio

9.2.2.5 Moisture content

9.2.2.6 Trace elements and secondary elements (optional)

(ppm for each element, if any)

Optional: animal or plant substrate without ratio.

9.3 Net mass in kg

9.4 FPA registration number

9.5 Back

9.5.1 Contents (Net mass, in kg.)

Annex A

Determination of total water (Thermal oven method)

A.1 This method determines total water in mixed fertilizers. It is not applicable to yield samples of volatile substances other than water at drying temperature.

A.2 Apparatus

A.2.1 Constant temperature oven

A.2.2 Weighing dish with cover

A.2.3 Desiccators containing anhydrous magnesium perchlorate or other suitable desiccant.

A.3 Procedure

A.3.1 Weigh 2 g of sample into a tared weighing dish.

A.3.2 Place the dish, with cover removed, in the drying oven at 100 ^{o}C ± 1 ^{o}C for 5 hours.

A.3.3 Remove from the oven, cover the dish and cool in the desiccator.

A.3.4 Weigh and determine the weight loss. Repeat procedure until constant weight loss is attained.

A.4 Calculation

$$\% \text{ Total Water} = \frac{\text{Weight loss (g)}}{\text{Weight of sample (g)}} \times 100$$

Annex B

Determination of organic carbon and organic matter (Walkley-black method)

B.1 Reagents

B.1.1 Potassium dichromate solution. Dissolve 49.04 g of $K_2Cr_2O_7$ in 1 liter of distilled water. Dichromate should be dried at 200 ^oC for 2 hours.

B.1.2 H_2SO_4, concentrated.

B.1.3 H_3PO_4, 85 %.

B.1.4 Diphenylamine indicator. Dissolve 0.5 g diphenylamine in 20 mL distilled water. Add 100 mL H_2SO_4 and mix.

B.1.5 $FeSO_4$ solution, 0.5 N. Dissolve 140 g of $FeSO_4$ or 200 g of $Fe(NH_4)_2SO_4$ in 15 mL concentrated H_2SO_4. Make up to 1 liter with distilled water.

B.2 Procedure

B.2.1 Weigh 0.025 g sample.

B.2.2 Place in Erlenmeyer flask and add 10 mL $K_2Cr_2O_7$.

B.2.3 Add 20 mL H_2SO_4.

NOTE If color changes immediately to green, reduce the sample. Stand for 30 minutes. Dilute to 200 mL.

B.2.4 Add 10 mL of 85%H_3PO_4, then add 1.0 mL diphenylamine indicator.

B.2.5 Titrate against $FeSO_4$, end point is blackish green.

B.3 Calculation

B.3.1 Calculate for % organic carbon (o.c.)

$$\text{N of } FeSO_4 = \frac{10}{\text{Vol. of } FeSO_4 \text{ used}}$$

$$\%\ \text{o.c.} = \frac{(V_{\text{blank}} - V_{\text{sample}}) \times \text{N } FeSO_4 \times 0.399}{\text{Weight of sample}}$$

B.3.2 Calculate for % organic matter

$$\%\ \text{organic matter} = \%\ \text{o.c.} \times 1.72$$

Annex C

Germination test

[1]CCME Compost maturity criteria

The CCME deemed a compost mature if it meets two of the following requirements:

- ◊ C:N ≤ 20
- ◊ Oxygen uptake ≤ 150 mg O_2/kg volatile solids/hour
- ◊ Germination rate of cress (*Lepidium sativum*) and radish (*Raphanus sativus*) seeds in compost must be greater than 90 % of the germination rate of the control sample, and plant growth of the compost-soil mix must not differ by greater than 50 % when compared to a control.

OR

- ◊ Compost must be cured for at least 21 days; and
- ◊ Compost will not reheat upon standing to greater than 5 ^{o}C above ambient Philippine temperature.

OR

- ◊ Compost must be cured for a minimum of 21 days, and
- ◊ Reduction of organic matter must be > 60 % by weight.

OR

- ◊ If no other determination of maturity is made, the compost must be cured for 6-month period under aerobic conditions. This curing stage begins when the pathogen reduction process is complete and the compost no longer reheats to thermophilic temperatures.

Table C.1 – Classification of compost

	Catergory
CCME (provinces and territories) [2]BNQ [3] AAFC	A, B AA, A, B One category based on trace element limits of B

[1] Canadian Council of Ministers of the Environment
[2] Bureau de Normalisation du Quebec
[3] Agriculture and Agri-Food Canada

Under the BNQ standard, compost may be categorized as AA, A or B. Types AA and A are of higher quality than type B. The requirements for Type B compost are considered to be the minimum necessary to obtain good compost. Under the CCME guideline, two compost categories have been established. Category A compost can be used for all types of applications: on agricultural lands, in residential gardens, in horticultural operations, or nursery and other enterprises. Category A criteria for

trace elements are achievable using source separated municipal solid waste feedstock. Category B compost has restricted use. It may be controlled under provincial or territorial regulations. For 'fertilizer' use, the AAFC recognizes only one class of compost, reflective of product safety criteria. It is based on the limits of category and type B compost for trace elements and reflects the requirements of the standards for pathogenic organism, maturity and the presence of sharp objects.

Due to the variability of results and variations on the germination test procedures by many scientists, Warman (1999) suggested that more research using different test plants and other bioassay procedures must be done in order to achieve a universal test procedure for evaluating compost maturity.

***CCQC Compost maturity index**

The CCQC uses a minimum of three parameters:

- ◊ C: N ≤ 20
- ◊ Group A tests
  - o Carbon dioxide release or respiration
  - o Oxygen demand
  - o Dewar self-heating test

- ◊ Group B tests
  - o Ammonia:nitrate test
  - o Ammonia concentration
  - o Seed germination or plant growth test.

Method	Units	Ratings		
		Very mature	Mature	Immature
CO_2 test	C g^{-1} day^{-1}	< 2	2 - 8	> 8
Ammonia:Nitrate	No units	< 0.5	0.5 – 3	> 3
Total ammonia	mg kg^{-1}, dry basis	< 100	100 < 500	> 500
Seed germination	% of control	> 90	80 – 90	< 80
Plant trials	% of control	> 90	80 - 90	< 80

* California Compost Quality Council

Plant assay for determining compost quality

Germination is the emergence and development of the seedling to a stage where its essential structures indicate whether or not it is able to develop further into a satisfactory plant under favourable conditions in soil (Basra, 1995).

Zucconi et al. (1981) proposed germination tests using *Lepidium sativum* L. and a compost extract to determine compost maturity. Some modifications to the procedure such as seed soaking, direct seeding into compost or compost-peat mixture, use of centrifuging instead of filtering to separate compost from the supernatant have been made (Inbar et al., 1990; Inbar et al., 1993; Grebus et al., 1994; Keeling et al., 1994; Gajdos, 1997; Warman, 1999; Buckerfield et al., 1999). Variations in the test plant species have also been made such as the use of Chinese cabbage (Warman and Termeer, 1996; Warman, 1999), ryegrass (Inbar et al., 1993), and komatsuna (Chanyasak et al., 1983).

Plants as indicators have been used along with chemical assay in investigations on compost and vermicompost maturity. Radish and marigold are among the commonly used in plant bioassays.

Plant seeds that may be used for germination test: Radish, marigold, or Chinese cabbage Seed vigor test (Source: Ang Lopez, 2001)

Line a petri dish with filter paper moistend with deionized water. Place 20 test seeds on the filter paper and keep the petri dish in the dark at 22 °C. Count the number of germinated seeds after 5 days. (Germination count must not be less than 85 %. Adjustment on the number of seeds to be used in the Germination Count Test must be adjusted if the germination in the seed vigor test is less than 85 %.

Germination test using 1:4 (w/v) or 1:8 (w/v) Compost extract (Warman 1999)

Line a petri dishes (9 cm) with Whatman No.1 paper. Moistened the filter paper with 5 mL of the extract. The filter paper in control petri dish must be moistened with 5 mL of deionized water.

In three replications, place 30 seeds of radish, or marigold placed in the dishes and germinate in the dark at 20 °C. Take germination count after 48 hours.

Direct seed germination test (Warman 1999b)

The direct seed germination test (Warman, 1999b) on radish, marigold and upland cress, done in three replicates, was conducted by mixing vermicompost with Pugwash sandy loam soil in 5 % and 10 % (w/w) combinations. Seventy-five mL of moist vermicompost soil mix was placed in each cell pack. Each treatment was seeded with 30 seeds of each test plant. Moisture in the cell was maintained by adding deionized water as required. The cell packs were kept under 12 to 14 hours of light daily at 24 °C ±2 ºC in the plant growth chamber. Germination count was taken ten days after seeding, after which, the plantlets were thinned down to 2 in each cell.

Annex D

Determination of total nitrogen

D.1 Reagents

D.1.1 H_2SO_4, concentrated.

D.1.2 Salt mixture. Mix together 100 g K_2SO_4, 10g $CuSO_4 \cdot 5H_2O$ and 1.0 g Se or 1.4 g SeO_2.

D.1.3 Sodium hydroxide, 40 %. Dissolve 400g NaOH flakes in 1 liter distilled water. Cool in water bath with running water.

D.1.4 Boric acid, 2 %. Dissolve 20 g boric acid in 1 liter distilled water. Heat to hasten dissolution.

D.1.5 Mixed indicator. Dissolve 0.099 g bromocresol green and 0.066 g methyl red in 100 mL ethanol.

D.1.6 Standard H_2SO_4, 0.03 N.

D.2 Procedure

D.2.1 Digestion (NOTE – Run a blank test on the reagents).

D.2.1.1 Nitrate free samples (Organic fertilizers and samples that do not contain nitrates).

1.0 g sample
2.0 g salt mixture
Shake or mix before digestion
40.0 mL conc. H_2SO4

Dilute to 250 mL after cooling and mix.

D.2.1.2 Organic fertilizers and samples containing nitrate (NH_4NO_3, KNO_3, etc.)

1.0 g sample or 0.5 g sample

3.0 mL H_2SO_4 – salicylic acid mixture (1.0 g salicylic acid + 30 mL conc. H_2SO_4)

a) Thoroughly mix and let it stand for 30 minutes.

b) Add 5.0 g sodium thiosulfate ($Na_2S_2O_2$)

c) Shake and let it stand for 5 minutes. Digest with slow heating (preheated at setting 5) until foaming lessens (5 to 10 minutes). Let cool. Continue digestion until clear solution results. Dilute to 250 mL after cooling and mix.

D.2.2 Distillation

Take 20 mL aliquot of the solution and transfer to a distilling apparatus. Add 25 mL of 40 % NaOH. Collect 50 mL to 75 mL distillate using a receiver containing 10 mL of 2 % boric acid solution and 0.5 mL mixed indicator. Titrate distillate with 0.03 N H_2SO_4.

D.3 Calculation

$$\% N = \frac{(V \text{ in mL } H_2SO_4 - V \text{ in mL Blank}) \times N\ H_2SO_4 \times 14/1000 \times D.F.}{\text{Weight of sample}} \times 100$$

where:

D.F. is the dilution factor.

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

PNS 85:1984/AMD 01:1992 – Fertilizers – Solid Fertilizer – Method of Sampling

PNS 95:1987 – Packaging – Bags for Solid Fertilizers – Specification

PNS 1033:1993 – Fertilizers – Marking – Presentation and Declaration

Fertilizer Regulatory Policies and Implementing Guidelines or “Bluebook”

Ang Lopez M. 2001. Quality and Maturation of Vermicompost Derived from Different Feedstocks. MSc. Thesis. Nova Scotia Agricultural College/ Dalhousie University. Nova Scotia, Canada.

Warman, P.R. 1999a. Lab Methods for Compost Quality Evaluation, CBA Press, Inc. Truro, NS, Canada, 27 pp.

Warman P.R. 1999b. Evaluation of seed germination and growth tests for assessing compost maturity. Compost Science and Utilization, 7(3): 33-37.

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