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SECTION 52-THE AGRICULTURE (FERTILISERS) REGULATIONS *Regulations by the Minister*

*Statutory
Instrument
476 of 1969
117 of 1970
Act No.
13 of 1994*

PART I

PRELIMINARY

1. These Regulations may be cited as the Agriculture (Fertilisers) Regulations.

Title

2. These Regulations shall apply to any fertiliser as defined in section *two* of the Act. Application

PART II

REGISTRATION OF PLANT

3. (1) Applications under Part II of the Act for registration, transfer of registration or renewal of registration of plant shall be made in Form FERT. 4 in the First Schedule, and such application shall be accompanied by the appropriate fees shown in the First Schedule and the Second Schedule to the Act, and be given to the Registering Officer. Registration of plant and fees

(2) The Registering Officer shall issue a certificate of registration in Form FERT. 5 in the First Schedule.

(3) The Registering Officer shall issue a certificate of provisional registration in Form FERT. 6 in the First Schedule.

4. The Registering Officer shall keep a register of plant as prescribed in Form FERT. 1 in the First Schedule. Register of plant

5. Any plant within the definition in section *two* of the Act shall be so equipped as to permit the adequate performance therein of the activities described in the application for registration of such plant, to the satisfaction of the Registering Officer. Requirements of plant

PART III

ANALYSTS AND LABORATORIES

6. (1) For the purposes of the Act, an analyst shall furnish proof to the satisfaction of the Minister that he has competent knowledge of chemistry and of chemical analyses, as applied to fertilisers. Such proof shall in every case comprise documentary evidence that such person holds a certificate or diploma attesting his possession of the requisite knowledge and given by a recognised competent body. All such documentary evidence shall be submitted to the Minister when applying for approval. The Minister may call for further evidence if required in any particular case.

Approval of
analysis

(2) Where the requirements referred to in sub-regulation (1) are satisfied, the Registering Officer shall issue a certificate of approval in Form FERT. 7 in the First Schedule.

7. (1) An approved laboratory shall be so equipped as to enable approved analysts to perform accurately for the purposes of the Act all the analyses specified under the Third Schedule, and such laboratories shall have been inspected by a duly authorised officer of the Ministry of Agriculture before approval by the Minister and may be inspected from time to time as the Registering Officer may deem necessary:

Approval of
laboratories

Provided that, in addition, other laboratories may be approved for certain analyses only, such analyses to be specified by the Registering Officer after inspection by a duly authorised officer of the Ministry of Agriculture.

(2) Where the Minister approves a laboratory, the Registering Officer shall issue a certificate of approval in Form FERT. 8 in the First Schedule.

8. The Registering Officer shall keep a roll of approved analysts in Form FERT. 2 in the First Schedule.

Roll of analysts

9. The Registering Officer shall keep a roll of approved laboratories in Form FERT. 3 in the First Schedule.

Roll of laboratories

PART IV

SEARCHES AND SEIZURES

10. The certificate of authority to be held by inspectors under section *twenty-five* of the Act shall be issued by the Registering Officer and shall be-

Certificates of authority for inspectors

(a) in the case of general authorisation, in Form FERT. 11 in the First Schedule; and

(b) in the case of limited authorisation, in Form FERT. 12 in the First Schedule.

PART V

SALE OF FARMING REQUISITES

11. The statement of analysis for each class of fertiliser as defined in the Fifth Schedule shall appear in English in lettering both durable and legible on the bag or container containing the same or on a label securely attached thereto.

Statements of analysis for sales in bags, containers, etc.

12. Where any class of fertiliser as defined in the Fifth Schedule is sold in bulk, the statement of analysis for such class shall appear in English in lettering both durable and legible on a note which shall be given to the purchaser or his agent at the time of delivery of such fertiliser.

Statements of analysis for sales in bulk

13. Where any class of fertiliser as defined in the Fifth Schedule is sold in a container or a package under a trade name, trade mark, trade label or trade brand, as provided by section *thirty of the Act*, there shall appear in English in lettering both legible and durable on the container or package or on a label securely attached thereto, a statement of analysis in respect thereof and, in addition, there shall be lodged with the Registering Officer, in respect of such fertiliser, a statement of particulars specified in the Sixth Schedule.

Statements of analysis for sales under trade names, etc.

PART VI

SAMPLING, ANALYSIS AND LIMITS OF VARIATION

- 14.** A report of analysis shall be issued by the analyst performing the analysis in respect of every sample taken under the Act, and any such report shall be in Form FERT. 9 in the First Schedule. Form of report to be used
- 15.** A certificate of analysis shall not be issued unless the sample has been taken in accordance with the Second Schedule and such certificate shall be in Form FERT. 10 in the First Schedule. Form of certificate to be used
- 16.** Samples for analysis for the purposes of the Act shall be taken in the manner prescribed in the Second Schedule and certificates of sampling issued in relation thereto shall be in Form FERT. 13 in the First Schedule. Method of taking samples
- 17.** Methods of analysis shall be as prescribed in the Third Schedule. Method of analysis
- 18.** The limits of variation in respect of any prescribed analysis shall be as prescribed in the Fourth Schedule. Limits of variation

FIRST SCHEDULE

CERTIFICATES AND FORMS

FORM FERT. 1

REPUBLIC OF ZAMBIA

THE AGRICULTURE (Fertilisers and Feed) Act

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 4 and Regulation 4)

REGISTER OF PLANT

Certificate Number and Date	Location	Name and Purposes for which Registered	Address of registered owner	Remarks (e.g., if only provisional)

FORM FERT. 2
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 20 (a) and Regulation 8)

ROLL OF APPROVED ANALYSTS AND ANALYSTS APPROVED FOR
SPECIAL TECHNIQUES

Name	Address	Recognised qualifications	Purposes for which approved (general or special)	Date approved	Certificate Number	Remarks

NOTE.-Date of withdrawal of approval shall be noted in "Remarks" column opposite the analyst.

FORM FERT. 3
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 20 (b) and Regulation 9)

ROLL OF APPROVED LABORATORIES

Name and address of Laboratory	Names of approved analysts attached to laboratory	Purposes for which approved	Date of withdrawal	Certificate Number	Remarks (e.g. types of analysis)

FORM FERT. 4

REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Sections 5 (1), 11 (1), (3), 17 (1), (2) and Regulation 3)

APPLICATION FOR REGISTRATION, TRANSFER OF REGISTRATION OR
RENEWAL OF REGISTRATION

Name of applicant

Address

Address of plant

Nature of activities to be carried out in plant

.....

.....

Owner of plant

Address of owner

Please state whether you are applying for*-

Fee units

(a)	First registration of plant	..	..	..	..	..	..
	60						
(b)	Annual renewal of registration of plant	..	..	..	..	..	..
	.. 30						
(c)	Provisional registration of a plant	..	..	..	..	..	..
	30						
(d)	Provisional registration of a transferee from, or successor in interest to a registered owner, as registered owner on the register of plant	..	..	..	..	..	..
	.. 30						
(e)	Full registration of a transferee from, or successor in interest to a registered owner, as registered owner on the register of plant	..	..	..	..	..	..
	60						

NOTE.-Fees should accompany this application.

* Strike out those inapplicable.

FOR OFFICIAL USE ONLY

Ref. No. Date
 received

Fee units

First registration	60	
Renewal.		30
Transfer (Provisional).	30	
Transfer (Full).		60
Provisional registration	30	

Fee paid

Date.....

Inspection by

Remarks

Certificate issued by

Certificate No.

Date

NOTES:

1. This form should be used when applying for registration of any plant or plant ownership.
2. Where a plant is owned by more than one person then one person should be nominated and registered as owner for the purposes of the Act.
3. After this application has been received your plant will be inspected and you will be informed whether or not your plant has been approved for registration with or without conditions.
- 4 .If such an inspection is not immediately practicable your application for registration may be classed as "provisional".

(As amended by Act No. 13 of 1994)

FORM FERT. 5

REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 10 (1) and Regulation 3)

CERTIFICATE OF REGISTRATION OF PLANT

This is to certify that the plant situated at
and used for the purpose of
and owned by has been inspected,
approved and registered for the purposes of the Act.

This certificate should be displayed in a prominent place in the plant.

.....
Registering Officer

Date

No.

Receipt No.

FORM FERT. 6
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Sections 8 and 9 and Regulation 3)

CERTIFICATE OF PROVISIONAL REGISTRATION OF PLANT

This is to certify that the plant situated at and used for the purposes of and owned by has been provisionally registered for the purposes of the Act.

This certificate should be displayed in a prominent position in the plant.

.....
Registering Officer

Date

No.

Receipt No.

FORM FERT. 7
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 18 (1) and Regulation 6)

CERTIFICATE OF APPROVAL OF ANALYST

This is to certify that the Minister of Agriculture, Food and Fisheries has approved as an analyst for the purposes of the Act.

.....
Registering Officer

Date

No.

FORM FERT. 8
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 19 (1) and Regulation 7)

CERTIFICATE OF APPROVAL OF LABORATORY

This is to certify that the Minister of Agriculture has approved
as a laboratory for the purposes of the Act, subject to the following limitations

.....
.....
.....

.....

Registering Officer

Date

Roll No.

FORM FERT. 9
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 21 and Regulation 14)

REPORT OF ANALYSIS

I certify that I received
on19.....,
a sample of
from
The report is as follows:
Laboratory number
Sample number

Date

Analyst

NOTE.-To be completed in triplicate and copies despatched as follows:

Original -Owner or Seller.

Duplicate -Inspector.

Triplicate -To be retained by Analyst.

FORM FERT. 10
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Sections 21 and 47 and Regulation 15)

CERTIFICATE OF ANALYSIS

I certify that I received
on,
19.....
a sample of
from
and the analysis of this sample is as declared below.
Laboratory number
Sample number

Constituent	Declared Analysis	Actual Analysis

Date

Analyst

NOTE.-To be completed in triplicate and copies despatched as follows:

Original-Owner or Seller.

Duplicate-Inspector.

Triplicate-To be retained by Analyst.

FORM FERT. 11
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Sections 24 (2) and 25 (2) and Regulation 10)

CERTIFICATE OF AUTHORITY FOR INSPECTOR

This is to certify that
has been duly authorised as an Inspector of farming requisites for the purposes of the Act
and is empowered to exercise all the powers therein described anywhere in Zambia.

Certificate number

.....

Inspector

Date

Registering Officer

FORM FERT. 12
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 24 and Regulation 10)

CERTIFICATE OF LIMITED AUTHORITY FOR INSPECTOR

This is to certify that
has been granted limited authorisation to act as an Inspector of farming requisites for the
purposes of the Act and is empowered to exercise all the powers therein described except as
stated below.

Signature of Inspector

Certificate number

Date

.....

Registering Officer

FORM FERT. 13
REPUBLIC OF ZAMBIA

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 52 (h) and Regulation 16)

CERTIFICATE OF SAMPLING

I certify that the accompanying is/are sample(s) of

taken by me on,19....., at
from stock in charge of
in the presence of

(name and address of witness)

The following particulars are given in connection with this/these sample(s).

Sample No.	Description of goods represented by this sample	Quantity of goods represented by this sample

Other particulars

Declared analysis as set out in the Fifth Schedule and trade name, trade brand or trade mark, etc., under which sold

Signature of witness

Signature of Inspector

Date

NOTE.-This form is to be completed in triplicate and should be despatched as follows:

Original-Analyst.

Duplicate-Owner or Seller.

Triplicate-To be retained by Inspector.

SECOND SCHEDULE

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 25 (1) (a), (1) (b) and Regulation 16)

METHOD OF TAKING SAMPLES

NOTE.-In this regulation "metric ton" is defined as 1,000 kg.

1. Where the fertiliser is contained in packages the samples shall be taken from different parts of the whole quantity as follows:

(a) if the quantity does not exceed two and a half metric tons, from not less than two unopened packages per ton or part thereof;

(b) if the quantity exceeds two and a half metric tons, from one additional unopened package for every additional ton or part thereof:

Provided that in no case need samples be taken from more than twenty packages.

2. Where the fertiliser is not contained in packages, not less than two samples per ton or part thereof shall be taken from different parts of the whole quantity:

Provided that not less than six shall be taken and not more than fifty need be taken.

3. The samples shall be taken by means of a suitable sampling probe or by such other means as will ensure, as far as is practicable, the taking of a representative sample.

4. The samples thus taken shall be thoroughly mixed and reduced in size to give a final sample not exceeding six pounds in weight. This final sample shall be mixed and divided into three parts and each of these parts shall be transferred to a clean, dry, non-corrodible container capable of being closed in such a manner as to preserve the contents of the container in their original condition. These three containers shall be so sealed so that they cannot be opened without breaking the seal. Each of these three parts shall be marked with the name of the fertiliser, date and place of sampling and the sample number together with the name of the inspector taking the sample.

5. The first part shall be given to the owner or seller of the fertiliser or his agent, the second part shall be delivered to an approved analyst for analysis, and the third part shall be retained by the inspector for a period of not less than six months after the date on which the Report or Certificate of Analysis is issued.

6. A Certificate of Sampling (Form FERT. 13 in the First Schedule) shall be made out in triplicate at the time of sampling and the relevant copies as detailed in Form FERT. 13 in the First Schedule should accompany each part of the sample.

(As amended by S.I. No. 117 of 1970)

THIRD SCHEDULE

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 52 (i) and Regulation 17)

METHODS OF ANALYSIS OF FERTILISERS

1. PREPARATION OF SAMPLE:

- (a) Remove any extraneous matter which cannot be conveniently ground and allow for this when calculating results.
- (b) Grind the sample as rapidly as possible to pass through a sieve having apertures about 1 mm. square. In the case of granular fertilisers and dry powdered fertilisers grind a representative portion of about 250 g. to pass through a sieve having apertures about 0.25 mm. square.
- (c) Store the prepared sample in a non-corrodible air-tight container.
- (d) Where a sample is too moist to be ground in its original condition, mix the sample thoroughly and remove a portion for moisture determination. Dry the remaining portion at 100 degrees C except where the sample may lose ammonia or where the sample contains soluble phosphorus compounds. In these instances dry the sample in a desiccator over calcium chloride or silica gel, or alternatively by passing dry air at room temperature over the sample until it is in a suitable condition for grinding. The results of the analysis of the dried sample should be adjusted to the "as received" condition.

2. DETERMINATION OF MOISTURE:

Weigh to the nearest mg. about 5 g. of the sample and heat to 100°C for three hours, cool in a desiccator and weigh. Calculate the loss in weight as a percentage of the original weight.

3. DETERMINATION OF NITROGEN:

(a) REAGENTS

Ammonia alum.

Standard indigo solution.

Cautiously add 40 ml. of concentrated sulphuric acid to 1 g. of indigo carmine and stir until dissolved. Pour the solution into 800 ml. of water, cool and dilute to 1 litre. Adjust the strength of the solution to comply with the following test:

Add 20 ml. to a solution of 4 mg. of potassium nitrate in 20 ml. of water. Add rapidly 40 ml. of concentrated sulphuric acid and heat to boiling; the blue colour is just discharged in one minute.

Concentrated sulphuric acid.

1 : 9 *Sulphuric acid*-Cautiously add 100 ml. of concentrated sulphuric acid to 900 ml. of water. Cool and dilute to 1 litre.

1 : 1 *Sulphuric acid*-Cautiously add 500 ml. of concentrated sulphuric acid to 500 ml. of water. Cool and dilute to 1 litre.

Anhydrous sodium sulphate.

Cupric sulphate.

Paraffin wax.

Granulated zinc.

Light magnesium oxide.

50% sodium hydroxide solution-Dissolve 500 g. of sodium hydroxide in water and dilute to 1 litre.

0.1 N Hydrochloric acid.

Mixed indicator solution-Grind together in an agate mortar 0.6 g. of methyl red and 0.6 g. of methylene blue. Dissolve the mixture in 500 ml. of 95% ethanol. Shake, filter and store in a dark glass bottle.

2% Boric acid solution-Dissolve 20 g. of boric acid in water, dilute to 1 litre and add 5 ml. of the mixed indicator solution.

Devarda's alloy: Finely powdered-not less than 80% to pass through a sieve having apertures of about 0.25 mm. square.

(b) TEST FOR ABSENCE OF NITRATES

Shake 5 g. of the sample with 80 ml. of water in a 100 ml. volumetric flask. Add 1 g. of ammonia alum, dilute to 100 ml., shake well and filter into a dry beaker. Dilute 1 ml. of the filtrate with 8 ml. of water. Add 1 ml. of standard indigo solution and 10 ml. of concentrated sulphuric acid. Heat to boiling point. If the colour is not discharged regard the sample as free from nitrates.

(c) TOTAL NITROGEN (ORGANIC AND AMMONIACAL) IN THE ABSENCE OF NITRATES

(i) Weigh to the nearest mg. about 2 g. of the sample (or an amount containing not more than 250 mg. of nitrogen) and transfer to a Kjeldahl flask. Add 25 ml. of concentrated sulphuric acid and approximately 10 g. of anhydrous sodium sulphate containing 0.4 g. of cupric sulphate. Heat gently until frothing ceases, increase the heat and continue the digestion until the liquid is practically colourless. Continue to heat for a further hour. If frothing is excessive add about 0.5 g. of paraffin wax. Avoid local overheating.

(ii) Transfer the cooled digest to 250 ml. volumetric flask. Thoroughly wash the Kjeldahl flask with successive portions of water carefully adding the washings to the digest in the volumetric flask. When cool adjust the contents of the volumetric flask to a volume of 250 ml. with water. Thoroughly mix the contents of the flask and pipette an aliquot such as to give a final titration of at least 4 ml. into a Kjeldahl flask. Add 250 ml. of water, a small zinc granule and sufficient 50% sodium hydroxide solution to neutralise the

acid and give about 10 ml. in excess. Mix well and connect immediately to a distillation apparatus. Distil into an appropriate volume (usually 30 ml.) of 2% boric acid solution. Titrate the contents of the receiving flask with 0.1 N hydrochloric acid. The colour change is from green to purple. Carry out a blank test using 2 g. of sucrose in place of the sample and subtract the titration value of the blank from that of the sample. Express the result in terms of nitrogen (N). 1 ml. of 0.1 N hydrochloric acid = 0.0014 g. nitrogen.

(d) TOTAL NITROGEN (ORGANIC, AMMONIACAL AND NITRIC) IN THE PRESENCE OF NITRATES

Weigh to the nearest mg. about 1 g. of the sample (or an amount containing not more than 250 mg. of nitrogen) and transfer to a Kjeldahl flask. Add 3 g. of Devarda's alloy and wash down the neck of the flask with 50 ml. of water. Close the flask with a rubber stopper fitted with (a) a tap funnel and (b) a delivery tube connected to a U-tube (with bulbs) containing 20 ml. of 1 : 9 sulphuric acid. Add 5 ml. of 50% sodium hydroxide solution through the tap funnel, allow to stand for thirty minutes and then heat at just below boiling point for sixty minutes. Cool, add 20 ml. of 1 : 1 sulphuric acid through the tap funnel, washing the neck of the flask. Remove the rubber stopper, wash the contents of the U-tube into the Kjeldahl flask, add 25 ml. of concentrated sulphuric acid and heat until all the water has boiled off. Add approximately 10 g. of anhydrous sodium sulphate containing 0.4 g. of cupric sulphate and heat gently until frothing ceases. Increase the heat and continue the digestion for a further hour. Avoid local overheating. Cool, and complete the determination by the method described under (c) (ii).

(e) AMMONICAL NITROGEN

Weigh to the nearest mg. about 5 g. of the sample, transfer to a 250 ml. volumetric flask, dissolve in about 200 ml. of water, dilute to the mark and filter if necessary. Transfer 50 ml. of the solution (or an aliquot such as to give a final titration of at least 4 ml.) to a distillation flask, add approximately 300 ml. of water and 20 ml. of 50% sodium hydroxide solution. (If urea is known to be present 10 g. of light magnesium oxide should be used instead of 50% sodium hydroxide solution.) Connect immediately to a distillation apparatus. Distil into 30 ml. of 2% boric acid solution. Titrate the contents of the receiving flask with 0.1 N hydrochloric acid. The colour change is from green to purple. Carry out a blank determination using sucrose in place of the sample and subtract the titration value of the blank from that of the sample. Express the result in terms of nitrogen (N). 1 ml. of 0.1 N hydrochloric acid = 0.0014 g. nitrogen.

(f) AMMONICAL AND NITRATE NITROGEN (IN INORGANIC FERTILISERS)

Weigh to the nearest mg. about 2 g. of the sample, transfer to a 250 ml. volumetric flask, dissolve in 200 ml. of water, dilute to volume and filter if necessary. Transfer 10 ml. of the solution (or an aliquot such as to give a final titration of at least 4 ml.) to a distillation flask. Add 10 g. of Devarda's alloy, 250 ml. of water and 15 ml. of 50% sodium hydroxide solution. Connect the flask immediately to the distillation apparatus and allow to stand in the cold for 15 minutes. Warm gently for 30 minutes, slowly increasing the temperature. Distil into 30 ml. of 2% boric acid solution. Titrate the contents of the receiving flask with 0.1 N hydrochloric acid. The colour change is from green to purple. Carry out a blank determination using sucrose in the place of the sample and subtract the titration value of the blank from that of the sample. Express the result in terms of nitrogen

(N). 1 ml. of 0.1 N hydrochloric acid = 0.0014 g. nitrogen.

4. DETERMINATION OF PHOSPHORUS:

(a) EXTRACTION OF SAMPLE

Weigh to the nearest centigram about 10 g. of the sample and transfer to a 500 ml. volumetric flask; add 400 ml. of water and shake the flask continuously for 30 minutes. Dilute the contents to the mark, mix well and filter.

(b) QUINOLINIUM PHOSPHOMOLYBDATE METHOD

(i) REAGENTS

Concentrated hydrochloric acid.

Concentrated nitric acid.

Calcium oxide-finely ground.

Calcium carbonate.

5 N sodium hydroxide solution.

Dilute hydrochloric acid-Dilute 240 ml. of concentrated hydrochloric acid with water to 1 litre.

Citric-molybdic acid solution-Stir 54 g. of molybdic anhydride (MoO_3) with 200 ml. of water, add 11 g. of sodium hydroxide and stir the mixture whilst heating to boiling point until the molybdic anhydride dissolves. Dissolve 60 g. of citric acid in about 250 ml. to 300 ml. of water and add 140 ml. of concentrated hydrochloric acid. Pour the molybdate solution into the acid solution, which is stirred throughout the addition. Then cool and, if necessary, filter the solution through a paper pulp pad. Dilute the solution to 1 litre. If the solution is slightly green or blue in colour, add dropwise a dilute (0.5 or 1.0%) solution of potassium bromate until the colour is discharged. This reagent should be kept in the dark.

Quinoline solution-Measure 60 ml. of concentrated hydrochloric acid and 300 to 400 ml. of water into a 1 litre beaker and warm to 70-80°C. Pour 50 ml. of quinoline in a thin stream into the diluted acid while stirring. When the quinoline has dissolved cool the solution, dilute to 1 litre, and, if necessary, filter through a paper pulp filter.

0.5 N sodium hydroxide-carbonate free.

Indicator solution-Mix 3 volumes of thymol blue solution and 2 volumes of phenolphthalein solution prepared as follows:

Thymol blue solution-Dissolve 250 mg. thymol blue in 5.5 ml. of 0.1 N sodium hydroxide solution and 125 ml. of industrial methylated spirit. Dilute with water to 250 ml.

Phenolphthalein solution-Dissolve 250 mg. phenolphthalein in 150 ml. of industrial methylated spirit. Dilute with water to 250 ml.

0.5 N hydrochloric acid.

0.1 N sodium hydroxide solution-carbonate free.

0.1 N hydrochloric acid.

Surface active agent-0.5% solution of sodium dodecyl benzene sulphonate is suitable.

Crystallised citric acid-monohydrate

(ii) PROCEDURE

Transfer a volume of the aqueous extract containing not less than 30 mg. of phosphorus and preferably about 20 mg. to a 500 ml. stoppered conical flask marked at 150 ml. Dilute with water to 150 ml., add 50 ml. of the citric-molybdic acid reagent, heat the solution to incipient ebullition, maintain it at this temperature for 3 minutes, and then bring it to boiling point. From a burette slowly add 25 ml. of the quinoline solution with constant swirling throughout, the first few ml. being added dropwise, the rest in a slow stream. Keep the solution gently boiling during the addition. Immerse the flask in boiling water for 5 minutes, then cool it to 150°C in running water.

Filter with suction the contents of the flask on a paper pulp pad, and wash the flask, precipitate and filter with successive small washes of cold water until they are free from acid. Transfer the filter pad and precipitate to the original flask, rinse the funnel with water and collect the rinsings in the flask. If necessary, wipe the funnel with a small piece of damp filter paper to ensure complete removal of the precipitate and place the paper in the flask. Add water to a total of about but not exceeding 100 ml. Stopper the flask and shake it vigorously until the pulp and the precipitate are completely dispersed.

Remove the stopper and wash it with water, returning the washings to the flask. Add a measured volume of 0.5 N sodium hydroxide solution sufficient to dissolve the precipitate and leave a few ml. in excess. Shake the flask vigorously until all the precipitate dissolves. (To facilitate the dispersal of the precipitate, after addition of 0.5 N sodium hydroxide solution, a few drops of surface active agent may be added.) Add 0.5-1.0 ml. of the indicator solution and titrate the excess of sodium hydroxide with the 0.5 N hydrochloric acid until the indicator changes from violet to green-blue and then very sharply to yellow at the end point. Deduct the number of ml. of 0.5 N hydrochloric acid used from the number of ml. of 0.5 N sodium hydroxide, to ascertain the volume of 0.5 N sodium hydroxide equivalent to phosphorus.

Carry out a blank determination on all the reagents, omitting only the sample and using 0.1 N standard alkali and acid instead of 0.5 N for the titration. Calculate the blank in terms of 0.5 N alkali and subtract it from the original result.

Calculate the amount of phosphorus in the portion taken for analysis from the factor 1.0 ml. 0.5 N sodium hydroxide = 0.597 mg. phosphorus (P).

(c) SPECTROPHOTOMETRIC (VANADIUM PHOSPHOMOLYBDATE) METHOD

(i) REAGENTS

Potassium dihydrogen phosphate-containing at least 99.8% monopotassium dihydrogen phosphate.

Ammonium molybdate.

Ammonium vanadate.

Concentrated hydrochloric acid.

Concentrated nitric acid.

Calcium oxide-finely ground.

Standard phosphorus solution-Dissolve in water 2.1953 g. of potassium dihydrogen phosphate previously dried at 105°C for 1 hour and dilute to 1 litre. Make a 5 fold dilution (1 ml. = 0.1 mg. phosphorus (P)).

Vanadium molybdate reagent-Dissolve separately 20 g. of ammonium molybdate and 1 g. of ammonium vanadate in water, mix, acidify with 140 ml. of concentrated nitric acid and dilute to 1 litre.

Normal sodium hydroxide solution.

Crystallised citric acid.

(ii) STANDARDISATION OF INSTRUMENT

From a burette measure into a series of 100 ml. volumetric flasks 22.0, 23.0, 24.0, 25.0, 26.0 and 27.0 ml. of the standard phosphorus solution (i.e. 2.2, 2.3, 2.4, 2.5, 2.6 and 2.7 mg of P). Add 25 ml. of the vanadium molybdate reagent to each flask and dilute to 100 ml. with water. Shake and allow to stand for 10 minutes.

Set the spectrophotometer to the correct wavelength, say 4200 \AA , fill two 1 cm. cells with the 2.2 mg. solution and check the optical density of the cells. If there is a small difference select the cell with the smaller reading as the standard reference cell.

Determine the apparent optical density (corrected for cell differences) of the 2.3, 2.4, 2.5, 2.6 and 2.7 mg. phosphorus solutions referred to the 2.2 mg. phosphorus solution as standard.

Plot a calibration graph of scale readings against known phosphorus content.

(iii) ANALYSIS OF SAMPLE

To 25 ml. of the solution prepared according to paragraph 4 (a) add 1 ml. of concentrated nitric acid; heat to incipient ebullition on a hotplate and maintain it at this temperature for 10 minutes. Cool, neutralise with normal sodium hydroxide solution and then successively dilute until a final volume of about 25 ml. contains between 2.4 and 2.7 mg. of phosphorus.

Transfer this volume to a 100 ml. volumetric flask, add 25 ml. of the vanadium molybdate reagent, dilute to the mark, mix and allow to stand for 10 minutes. At the same time transfer 25 ml. of the standard phosphorus solution into a second 100 ml. volumetric flask. Add 25 ml. of the vanadium molybdate reagent, dilute to the mark, mix and allow to stand for 10 minutes.

Measure the difference in optical density between the two solutions and estimate the phosphorus content of the volume of the unknown solution from the calibration graph. Calculate the phosphorus content of the sample from known dilution factors and the weight of the sample.

NOTE.-Prepare a fresh reference standard for each series of readings on the instrument.

5. DETERMINATION OF POTASSIUM

(a) PERCHLORIC ACID METHOD

(i) REAGENTS

Concentrated hydrochloric acid.

Barium chloride solution-Dissolve 100 g. of barium chloride in water, filter the solution and dilute to 1 litre.

Dilute hydrochloric acid-Dilute 240 ml. of concentrated hydrochloric acid with water to 1 litre.

Calcium oxide-finely ground.

Ammonium hydroxide solution-sp. gr. 0.912.

Ammonium carbonate solution-saturated aqueous solution.

Ammonium oxalate solution-saturated aqueous solution.

20% perchloric acid solution.

Alcohol-industrial methylated spirit 95-96% v/v.

Wash solution-Add potassium perchlorate to alcohol and shake until a saturated solution is obtained. Keep the
solution over solid potassium perchlorate and filter *immediately* before use.

(ii) PREPARATION OF SAMPLE SOLUTION

(I) POTASSIUM SALTS FREE FROM SULPHATES AND OTHER INTERFERING SUBSTANCES

Dissolve in water a portion of the sample weighed to the nearest mg. equivalent in potassium content to 1.2 to 1.7 g. of potassium. Cool the solution, dilute to 500 ml. in volumetric flask, mix well and filter. Determine the potassium in 50 ml. of this solution by the method described in paragraph 5 (a) (iii).

(II) POTASSIUM SALTS CONTAINING SULPHATES

NOTE.-If sample contains phosphates, iron, manganese or substances other than sulphate that interfere with the determination of potassium the method described in paragraph 5 (a) (ii) (III) should be used.

Weigh to the nearest mg. a portion of the sample equivalent in potassium content to 1.2 to 1.7 g. of potassium into a 500 ml. beaker, add about 300 ml. of water and 20 ml. of concentrated hydrochloric acid and heat the solution to boiling. To the boiling solution cautiously add, drop by drop, barium chloride solution in an amount slightly in excess of that previously determined as necessary to ensure the complete precipitation of sulphate. Cool the liquid to 20 degrees C, transfer to a 500 ml. volumetric flask, dilute to 500 ml., mix, and filter through a dry filter. Take 50 ml. of the filtrate and evaporate to dryness in a basin; moisten the residue with concentrated hydrochloric acid, again evaporate to dryness, dissolve the residue with 5-10 ml. of dilute hydrochloric acid and filter if necessary. Determine the potassium in the solution by the method described in paragraph 5 (a) (iii).

(III) POTASSIUM IN MIXED FERTILISERS

Weigh to the nearest centigram about 10 g. of the sample and, if organic matter is

present, gently incinerate at a temperature not exceeding 500°C. Transfer the weighted portion of the sample or the incinerated residue to a 500 ml. beaker with a little water and 10 ml. of concentrated hydrochloric acid and then warm for 10 minutes. Dilute with water to about 300 ml. and bring gradually to boiling point. Add 10 g. of calcium oxide made into a paste with water, bring the contents again gently to boiling point, and keep so heated for about half an hour with frequent stirring. Cool to 20°C, transfer to a 500 ml. volumetric flask, dilute to 500 ml. and, after thoroughly shaking, filter through a dry filter paper. Transfer 250 ml. of the filtrate to another 500 ml. volumetric flask, make just acid with hydrochloric acid and heat to boiling point. To the boiling solution cautiously add, drop by drop, barium chloride solution until there is no further precipitation of barium sulphate. Render the contents of the flask alkaline with ammonium hydroxide solution, and precipitate the calcium and any excess of barium by adding ammonium carbonate solution until no further visible precipitation occurs, followed by the addition of 1 ml. of ammonium oxalate solution. Cool to 20°C, dilute with water to 500 ml. and after thoroughly shaking, filter through a dry filter paper. Measure 100 ml. of the filtrate and evaporate to dryness in a basin. Expel the ammonium salts from the residue by gently heating the basin over a low flame, being careful to keep the temperature below that of faint redness. Cool the residue, moisten with concentrated hydrochloric acid and again evaporate to dryness. Take up the residue with water and filter if necessary. Determine the potassium in the solution by the method described in paragraph 5 (a) (iii).

(iii) PROCEDURE

Transfer the solution obtained as described in paragraph 5 (a) (iii) (I), 5 (a) (ii) (II) or 5 (a) (ii) (III) into a basin and add about 7 ml. of perchloric acid solution. Place the basin on a hotplate or sand bath and evaporate the contents until white fumes are copiously evolved. Cool, and dissolve the precipitate in a little hot water. Add about 1 ml. of perchloric acid solution and again concentrate to the fuming stage. Thoroughly cool the residue in the basin and stir in 20 ml. of alcohol. Allow the precipitate to cool and settle; then pour the clear liquid through a dry filter paper, draining the precipitate in the basin as completely as possible. Redissolve the precipitate on the paper and that remaining in the basin with hot water, add 2 ml. of perchloric acid solution to the combined residue in the basin and thoroughly stir the contents with 20 ml. of alcohol. Allow the precipitate to cool and settle and pour clear liquid through a weighed Gooch or sintered glass crucible, draining the precipitate as completely as possible from the liquid before adding 5 ml. of the wash solution. Wash the precipitate by decantation with several similar small portions of the wash solution, pouring the washings through the crucible. Transfer the precipitate to the crucible and wash it well with the wash solution until free from acid. Dry the precipitate at 100°C and weigh. Regard the precipitate as potassium perchlorate (KClO_4) and calculate its equivalent as potassium (K) by multiplying its weight by 0.282. Calculate the potassium content of the sample.

5. (b) FLAME PHOTOMETRIC PROCEDURE

The determination of potassium by this method depends on the measurement of the characteristic radiation due to potassium emitted by a flame into which a solution of the sample is sprayed. The chosen radiations lie in the spectral range 7660-7700 . These radiations may be isolated by either a monochromator or the use of a suitable filter. This method must not be used where the potassium content of the material being analysed

exceeds 17% by weight.

(i) REAGENTS.

Potassium dihydrogen phosphate-containing at least 99.8% mono-potassium dihydrogen phosphate.

Concentrated hydrochloric acid.

Ammonium oxalate solution-saturated aqueous solution.

Ammonium hydroxide solution-sp. gr. 0.96.

Standard potassium solution-Dissolve in water 6.9608 g. of potassium dihydrogen phosphate previously dried for 1 hour at 105°C, and dilute to 1 litre in a volumetric flask. Shake well. Transfer 50 ml. to a 1 litre volumetric flask and dilute to the mark. Shake well. This solution contains 100 p.p.m. potassium (K).

(ii) PREPARATION OF SAMPLE SOLUTION

(I) POTASSIUM SALTS

If the sample contains ammonium, calcium, iron, aluminium or other interfering substances the procedure described under paragraph 5 (b) (ii) (II) should be used.

Weigh to the nearest mg. about 2.5 g. of the sample and transfer to a 400 ml. beaker. Add about 10 ml. of concentrated hydrochloric acid and 50 ml. of water and bring the contents to boiling point, breaking down with a stirring rod any lumps or crystals. Dilute the solution with water to about 100 ml. and boil gently for a few minutes. Cool the solution to 20°C, transfer to a 250 ml. volumetric flask, and dilute to the mark. Mix and filter through a dry filter. Successively dilute so that the final solution contains approximately 14 p.p.m. potassium (K) and determine potassium in the filtrate by the method described in paragraph 5 (b) (iii).

(II) POTASSIUM IN MIXED FERTILISERS

Weigh to the nearest mg. about 2.5 g. of the sample and transfer to a 400 ml. beaker. Add 125 ml. of water and 50 ml. of ammonium oxalate solution. Boil the contents for 30 minutes. If necessary a small quantity of potassium-free anti-foaming agent may be added. Cool the liquid, add a slight excess of ammonium hydroxide solution and cool to 20°C. Transfer to a 250 ml. volumetric flask and dilute to the mark. Mix the solution and filter through a dry filter. Successively dilute so that the final solution contains approximately 14 p.p.m. potassium (K) and determine the potassium by the method described in paragraph 5 (b) (iii).

(iii) METHOD OF ANALYSIS

(I) CALIBRATION OF INSTRUMENT

From the standard potassium solution prepare a set of accurate dilutions containing 8, 10, 12, 14, 16 and 18 p.p.m. potassium. Set the sensitivity of the flame photometer so that 100 scale divisions (full scale deflection) is equivalent to 18 p.p.m. potassium solution. Spray the 8, 10, 12, 14 and 16 p.p.m. potassium solutions three times. Take the median reading (not the mean) and construct a calibration graph. After spraying each different strength solution, again spray the 18 p.p.m. solution to ensure that the sensitivity of the flame photometer has not changed.

(II) ANALYSIS OF THE SAMPLE SOLUTION

Reset the instrument at 100 scale divisions (full scale deflection) with 18 p.p.m. potassium solution. Spray the diluted fertiliser solution prepared in accordance with paragraph 5 (b) (ii) (I) or 5 (b) (ii) (II) and read from the graph the approximate potassium content of the solution.

Prepare two further dilutions of the standard potassium solution to contain respectively 1 p.p.m. more and 1 p.p.m. less potassium than the estimated potassium content of the diluted solution of the sample. Successively spray the low standard solution, the diluted solution of the sample, and the high standard solution. Repeat this operation twice more. Take the median result of each set of three readings and calculate the potassium content of the sample solution and hence the fertiliser from the proportionality of the radiation given by the sample solution and that given by the two standard solutions containing respectively 1 p.p.m. more and 1 p.p.m. less potassium than the predicted potassium content. Dilute standard solutions should be freshly prepared.

6. FREE ACID IN SULPHATE OF AMMONIA

(a) REAGENTS

Methyl red indicator solution-Dissolve 25 mg. of methyl red in 5 ml. of 90% industrial methylated spirit with the aid of 0.5 ml. of 0.1 N sodium hydroxide solution. Dilute to 250 ml. with 50% industrial methylated spirit. If desired screened methyl red indicator may be used. 0.1 N sodium hydroxide solution-carbonate free.

(b) PROCEDURE.

Weigh to the nearest centigram about 20 g. of the sample and dissolve in about 50 ml. of water. Filter, wash any insoluble matter and the filter paper free from sulphate and dilute the combined filtrate and washings to about 250 ml. Add 2 or 3 drops of the indicator solution and titrate with 0.1 N sodium hydroxide solution. Express the result as percentage by weight of sulphuric acid (H_2SO_4). 1ml. O. 1 N sodium hydroxide solution = 0.0049 g. sulphuric acid (H_2SO_4).

FOURTH SCHEDULE

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 52 (g) and Regulation 18)

LIMITS OF VARIATION

The limits shown shall be the maximum variation allowed above and below the amount stated except in the case of sulphur.

1. *Limits Applicable to all Fertilisers Except in 2 below:*

Nitrogen	All forms of nitrogen expressed as % N: 1/10th of amount stated with a minimum of 0.3% N and a maximum of 1.0% N.
Phosphorus	Water-soluble phosphorus expressed as % P: 1/20th of amount stated with a minimum of 0.2% P and a maximum of 0.9% P.
Potassium	Total potassium expressed as % K: 1/20th of amount stated with a minimum of 0.6% K and a maximum of 1.7% K.
Chloride	Percentage chloride expressed as % Cl: 1/20th of amount stated.
Boron	Percentage boron expressed as % B: 1/5th of amount stated.
Sulphur	No variation allowed below minimum amount stated.

2. *Limits Applicable to Borax and Other Borates for Use as Fertilisers:*

Percentage boron expressed as % B: 1/10th of amount stated with a maximum of 1.0% B.

3. *Sulphate of Ammonia:*

In addition to the other limits applicable in 1 above, percentage of free acid content:

1/5th of amount stated or 0.025% whichever is the greater, expressed as percentage by weight of sulphuric acid (H_2SO_4).

FIFTH SCHEDULE

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Sections 28, 29 and 52 (k) and Regulations 11 and 12)

STATEMENTS OF ANALYSIS REQUIRED FOR DIFFERENT CLASSES OF FERTILISERS

<i>Class of Fertiliser</i>	<i>Statement of Analysis to be Shown on Bags, Containers or Labels, and Notes to Accompany Sales in Bulk</i>
Nitrogenous fertilisers	Percentage of total nitrogen.
Ammoniated phosphates and ammoniated super-phosphates.	Percentage of total nitrogen.
elemental form (P).	Percentage of water-soluble phosphorus expressed in the
(S).	Minimum percentage of sulphur expressed in the elemental form
Single, double or triple super-phosphates.	Percentage of water-soluble phosphorus expressed in the elemental form as (P).
Potassic fertilisers.	Percentage of potassium expressed in the elemental form (K).
Any other inorganic fertiliser or compound, complex, blend or mixture of fertilisers.	Percentage of total nitrogen (N).
	Percentage of water-soluble phosphorus expressed in the elemental form (P).
	Percentage of potassium expressed in the elemental form (K).
	Percentage of boron expressed in the elemental form (B).
(S).	Minimum percentage of sulphur expressed in the elemental form
Borax and other borates for use as fertilisers.	Percentage of boron expressed in the elemental form.

SIXTH SCHEDULE

THE AGRICULTURE (FERTILISERS AND FEED) ACT

THE AGRICULTURE (FERTILISERS) REGULATIONS

(Section 30 and Regulation 13)

STATEMENT OF PARTICULARS TO BE LODGED WITH THE REGISTERING OFFICER IN RESPECT OF FERTILISERS SOLD IN BAGS, CONTAINERS, ETC., UNDER ANY TRADE NAME, TRADE MARK, ETC., AS DESCRIBED IN SECTION 30 OF THE ACT

1. Percentage by weight of nitrogen:
 - (a) in the ammonium form;
 - (b) in the nitrate form;
 - (c) in the urea form;
 - (d) in any other form.
2. Percentage by weight of water-soluble phosphorus expressed as (P).
3. Percentage by weight of potassium expressed as (K):
 - (a) in the chloride form;
 - (b) in the sulphate form;
 - (c) in any other form.
4. The minimum percentage by weight of sulphur expressed as (S).
5. The percentage by weight of boron expressed as (B).
6. In the case of sulphate of ammonia only the percentage of free acid.
7. The trade name, brand name, etc., under which the product is to be sold.
8. By whom sold

Address