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**In 1982, the name of the International Superphosphate Manufacturers' Associations (ISMA) was changed to International Fertilizer Industry Association (IFA).*

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PRODUCTION AND DISTRIBUTION OF FLUID FERTILISERS

by : G. MORANDI (Montedison S.p.A. - Italy)

1. INTRODUCTION

The non-stop flow of labour from the country as well as mechanization which aims at eliminating manual labour to decrease costs led the big Italian farmers to use fluid fertilisers.

For that reason Montedison looked for fluid fertilisers consistent with the social and agronomic requirements of the most progressive areas of the Italian territory. This study started after a study of the statistics of production and consumption of these fertilisers in consuming countries.

With reference to the US market development and following TVA and NFSA research work, the increasing importance of the use of suspension fertilisers was noted (tables 1 and 2). This trend became more marked, since in 1967 only 7 % of fluid fertiliser plants produced suspensions, while this figure was 57.8 % in 1972.

We feel that the tendency towards the production of suspension is justified by the following three reasons :

1) possibility of obtaining products containing the three main nutrients

2) possibility of producing fertilisers as concentrated as conventional solid fertilisers

3) possibility of using low cost phosphate intermediates.

However the shift to suspensions requires the adoption of organization and distribution systems to mitigate the disadvantages : short shelf life and inconvenient to transport .

TABLE 1

Number of plants studied in the enquiry and types of fluid fertilisers

Plants	N°	%
Contacted	642	100.0
Producing only clear liquids	271	42.2
Producing only suspensions	120	18.7
Producing both types	251	39.1
Producing clear liquids	522	81.3
Producing suspensions	371	57.8

(biblio) F.P. ACHORN et N.L. HARGETT : Suspension Update - 1972
Fertilizer Solutions ; September/October 1972
pages 24-26-27-28-30-32

TABLE 2

Total annual production of fluid fertilisers in the plants under consideration

	Tons	%
Clear liquids	1,355,149	66.5
Suspensions	682,081	33.5
	2,037,230	100.0

(biblio) F.P. ACHORN et N.L. HARGETT : Suspension Update - 1972
Fertilizer Solutions ; September/October 1972
pages 24-26-27-28-30-32

Montedison started experiments on suspension fertilisers and tried to solve the specifically Italian problems.

In the production sector the main requirements are :

a) the use of readily available phosphate intermediates requiring no special conversion process

b) the development of a production process with the minimum possible pollution

c) to have the possibility of producing basic suspension fertilisers which by mixing could produce the largest possible range of formulations.

As far as application and market are concerned the requirements are :

1) an appropriate selection of the most developed and receptive agricultural areas where the benefits of liquid fertilisers appeal most

2) when selling fluid fertilisers, to combine the principle of supplying a fertilisation service with the choice of the most appropriate distribution system

3) locating distribution centres sufficiently close to the production plants so as not to affect the stability of suspensions and reduce the problem of supply as much as possible

4) at the beginning, for the most important crops (maize, wheat), to have a low NPK grade to act as the best complement to N applied as anhydrous ammonia and conventional N fertilisers.

Owing to production and market conditions, the investigation dealt with the following points :

1) laboratory studies to determine the production parameters on the basis of the most advantageous phosphate intermediate (wet process H_3PO_4) and of the systems for evaluating the stability of the suspensions obtained ;

2) pilot plant production of an amount of one or several products sufficient to determine the choice of production system and of product quality and, at the same time, supply enough suspensions to fulfil the needs ofinitial marketing ;

3) application in the field with the Montedison equipment to evaluate the response of the market to these "root delivered" fertilisers and to determine the factors for choosing a distribution network and the most appropriate type of application equipment.

2. LABORATORY INVESTIGATIONS

According to the above mentioned ideas, the investigation was made with low concentration wet process H_3PO_4 as P_2O_5 source. The absence of polyphosphoric acid does not allow high grade products to be made and, on the other hand, considerably reduces pollution problems in the environment due to H_3PO_4 concentration.

The main lines of the work were as follows :

1) Laboratory preparation and evaluation of basic suspension fertilisers capable of being mixed and, together with N solutions, manufacture of "tailor made" products, obtained by using 36 % P_2O_5 phosphoric acid as P_2O_5 source. Basic products are those with a nutrient ratio of 1:3:0 for NP fertilisers and 1:3:4 for NPK.
   In addition the development of one or several products recommended for integrated fertilization with anhydrous ammonia. There are fertilisers with a low N content (e.g. ammonia alone) but with a high P_2O_5 and K_2O content (e.g. nutrient ratio 1:3:0 ; 1:3:2 etc...).

2) Development of a standard preparation method in order to obtain the desired fertilisers with the best properties of the suspension.

3) Testing the various types of national and foreign suspension agents so that the choice is based on suspension properties, cost and supply possibilities.

The laboratory system to evaluate the stability of suspensions obtained after a maximum storage period of two months is based on the following criteria :

1) Stability of the suspension with regard to settling of the solid phase. To measure that factor, the rate of separation of an upper clear phase was determined either by gravity or by centrifugation (fig. 1).

As a qualitative assessment the possibility of removing the solid deposits at the bottom of the tanks was also determined.

2) Ability to get homogeneity e.g. control of recovery of initial physical conditions with rheological measurements by agitation, after long rest periods)

3) Tendency for crystal growth with age. This was determined by filtering known amounts of suspensions through a 0.83 mm mesh screen (20 mesh Tyler series screen) and collecting and weighing the crystals remaining on the screen

4) Variations of rheological characteristics with time. A rotary viscosimeter was used for the measurement, and the variations of extrusion limits and final thixotropy were particularly followed.

Using the above criteria it was found that, for a constant quantity of suspension agent, the storage properties of suspensions deteriorate when the nutrient content decreases. The effectiveness depends on the P_2O_5 content.

An increased N content, obtained by adding ammonium nitrate and urea or urea alone results in a substantial reduction of the storage period because of the increased sedimentation rate of solids due to an increased crystal growth (e.g. fertilisers like 18-9-9, 12-12-12 etc.). Products of that type should be prepared from basic constituents directly before application.

In the laboratory tests the importance of particle size and type of KCl was noted for the preparation of suspensions. The results obtained tend to exclude KCl with particle size exceeding 1 mm and red or granular KCl.

The measuring systems mentioned permitted the screening of the foreign (f.i. several types of attapulgite) and national (products of the benthonic type) suspension products. From the comparison of the various products used for preparing the same fertiliser types the good suspension properties of a national benthonic product was confirmed.

Contrary to the attapulgite based agents, this product requires a pre-gel formation stage with water, before mixing with the suspension, which increases the water balance.

The laboratory test data given by a batch preparation of suspensions were confirmed in a small continuous plant always producing about 30 kg/hour. In that stage emphasis was put on a product fulfilling the above mentioned market conditions.

A 1:3:3 product was chosen with the following formulations (% by weight) : N = 5 % ; P_2O_5 = 15 % ; K_2O = 15 %.

This low N product is a complement to N fertilisation with anhydrous ammonia. It is at the limit of products judged useable after the laboratory tests. Pilot tests confirmed that it was possible to make that product and to define its physical properties better (table 3). The suspension effect was obtained by using a national benthonic product added as pre-gel in an amount corresponding to 2 %.

TABLE 3

Mean physical properties of the 5-15-15 fertiliser

Density	1.41 g/cm^3
Viscosity	30 cp
Extrusion limit	45 dyn/cm^2
Thixotropy	nil
Clear phase separation starting point	2 days
Fraction of clear phase after one month	about 10 %
Easiness of homogenization	good
Crystal fractions after 2 months at 18° C	0.04 % > 20 mesh
Crystal fractions after 2 days at 0° C	0.1 % > 20 mesh

3. PILOT PLANT INVESTIGATION

The pilot plant built according to the laboratory results, with 100 t/d capacity and operating continuously, can be described as follows :

- Phosphoric acid neutralization section. It includes a reactor fed with anhydrous ammonia and 36 % P_2O_5 phosphoric acid. The reaction takes place at low temperature (40-70° C) and the heat is removed by circulation of liquid through a surface heat exchanger

- Pre-gel preparation. The suspension agent is fed together with water to a reactor with strong agitation for thorough mixing of the solid and liquid materials

- Preparation of the suspension. It takes place in an agitated reactor fed with the liquid resulting from phosphoric acid neutralization, the pre-gel and solid potash salt, after screening to remove any extraneous material. The mixed liquid is pumped to storage.

- Storage. It takes place in 100 m^3 - 1000 cm^3 carbon steel tanks equipped with a dehumidified air blower for agitation. Production was about 1000 t in 1972 and 3000 t in 1973.

4. APPLICATION AND MARKETING

Following the results of the previous stages and owing to the great amounts of product available, large scale marketing and application, of the suspension fertiliser 5-15-15 were initiated.

From the technical point of view the purpose of this action was :

1) to check the behaviour of the fertiliser under practical storage, transport and distribution conditions.

2) to collect practical data for the determination of the fundamental characteristics of application equipment based on the principle of "root delivered" sales and of the specific conditions of the agricultural areas concerned.

3) to collect information to obtain :

   - the optimum distribution network based on centres
   - the amount of fertilisers to be handled by the applicators
   - the best supply system for the centres

The distribution tests lasted two agricultural seasons (1972-73). During that period 4000 t 5-15-15 suspension were applied in North East Italy (Venetia, Frioul and Venetia Juliana). The crops concerned in that campaign were :

1) in the spring : maize
2) in the autumn : wheat

For both crops, the rates normally applied were about 800-1000 kg/ha.

4.1 Tests on the behaviour of the 5-15-15 suspension

In order to evaluate the stability of the suspension with time, production of 5-15-15 started a long time before the application period.

The following was found :

The 5-15-15 was stored for about two months in a tank at ambient temperature exceeding 0° C. The fertiliser could comply with the prerequisite qualities by 15 minutes agitation every 8 hours. A compressed air agitation system, different from the TVA one, was used. It consists in a series of T tubes immersed in the tank and fixed in such a way that the horizontal part of the T nearly touches bottom. The horizontal part of the tube is slit and designed so that compressed air escapes in sufficiently large bubbles. A single element is adequate for the agitation of 4 m^3. To improve agitation and, at the same time, avoid excessive bubbling, blowing follows a timed sequence.

The system gave good results. At the end of the campaign there was little residue at the bottom of the tanks. In addition this system improves the cleaning of the tanks. At that stage it was noticed that a good suspension depends on the quality of potassium chloride. Its particle size should not exceed 1 mm and red or granular KCl should not be used.

The best potassium chloride was found to be white potassium chloride with the following particles sizes :

- retained by 1 mm screen 0.5 %
- retained by 0.5 mm screen 7.0 %
- retained by 0.2 mm screen 61.0 %

The installation of a 1.5 mm mesh filter on the tank truck loading pipe, below the tanks, avoids many difficulties during application (such as nozzle plugging).

On the experimental scale, the transport of 5-15-15 suspension from the factory to the field was done with ordinary stainless steel tank trucks with capacity (truck-trailor) of 25-30 tons. They were equipped with an agitation system employed before unloading, based on bubbling either compressed air or the engine exhaust gases. The analyses reveal constant composition of the suspension even after transport. Emptying the tank confirmed that the amount of residues did not exceed 100-200 kg and contained a slight excess of K_2O. The residue depended partly on the separation of KCl, but also on the difficulty of completely emptying the tank-trucks of a rather viscous liquid.

4.2 Characteristics of the applicators

The application equipment must take account of the average agricultural form in Northern Italy and make the suspension fertiliser "root-delivered" at low cost. Farm size in Northern Italy is about 5-20 ha. Very often, even farms covering more than 100 ha include several scattered fields. In addition land improvement becomes a limiting factor because of agronomic and historical reasons. In fact the fields are 200-300 m to 1000-1500 m long and 35-50 m wide. The width of fields results from the necessity of drainage by small channels or ditches. It is also worth noting that trees and hedges planted at both ends of the fields prevent applicators turning round easily and that certain areas are very soft especially when they are wet. This structure considerably limits the size of application equipment and implies a compromise with the requirements of the service (fast high capacity independent machines). For these reasons, high capacity self propelled equipment (tanks exceeding 4 m^3, width of spread exceeding 15 m) was excluded and French and Belgian towed applicators were used with a width of spread of less than 15 m and a 2 m^3 tank (nearly 2.8 t 5-15-15). The suspension is sprayed by means of a high rate centrifugal pump. The nozzle pressure is 2.5 kg/cm^2.

Fertiliser application (litres/ha) is adjusted at constant pressure by the nozzle characteristics and tractor speed. The boom can be folded up manually. Initially the machine had tyres with a fairly small tread. This type was replaced by a broader smooth tyre. As a result ground compaction and boom oscillation were reduced and road transport was improved. The availability of spreading equipment with wheels having the same track as the tractor's wheels contributed the above goals being reached.

During the experimental phase, fertiliser was supplied directly by tank-trucks parked either in the farm-yard or near the field.
Under these conditions 4000 tons of 5-15-15 were applied at rates of 800-1000 kg/ha. The machine could operate at 3-4 ha/hour, e.g. 30 t/d fertiliser. After this treatment the boom system had to be reinforced. The optimum established width of spread is 12 m.

Appendix 1 gives, as examples, the working times of a typical application site and the effect on the working capacity of the machine of the speed of the tractor and the rates (100 kg/ha) applied.

4.3 Distribution network

As a result of the experience gained and the economic appraisal made, the distribution network should include equipped centres with an annual application capacity of 4000 tons, bearing in mind that the annual working period is about 60-70 days. Each centre should have a storage capacity for about two days' spreading. In view of the working capacity of the machines and the average number of days available for spreading 4000 t annually, each centre should have at least two machines. The supply would be provided by industrial tractors (maximum speed 60 km/hour) pulling 10-12 ton trailors.
According to the distribution radius of the centre, one tractor could supply one or two applicators. For a regular supply, it is desirable to have two or three 10-12 ton trailors for each applicator. In order to determine the means of supply the maximum radius should be fixed according to the spreading sites, taking account of tractor's speed and of the spreading capacity with a 10-12 ton trailor carrying suspension fertilisers.
As an example fig. 3 presents a time diagram relating to a spreading site involving two applicators operating at the same maximum actual distance from the centre compatible with the organization of the site itself. The supply of applicator is performed by one industrial tractor with four trailors.
For running the spreading site it was noticed that, owing to the working capacity of the machines (30 t/d of 5-15-15 suspension in 9 working hours and 2.9 t tank capacity) each trailor should be emptied about one hour before the applicators have exhausted their operational capacity.
A time delay of about 30 minutes for each trailor delivery was provided for. This time includes the loading and weighing operations in the centre. The maximum road distance from the centre at which the two applicators work is determined by the necessity of making four journeys in two hours. However, with an average speed of 50 kg/hour the road distance between the centre and the applicator should not exceed 25 km.

Appendix 1

ANALYSIS OF WORKING TIME

Equipment used

Towed applicator with a 2000 l tank and a 12 m width of spread.

General information

- Suspension : 5-15-15
- Operator : n° 1
- Supply : of a fixed tank with a pump having a flow rate of 350 l suspension per min.
- Distance of the tank to the spreading site : at the field edge
- Size of the field : length 600 m, width 48 m

Analysis of individual times of the working site

The total time includes the following individual ones :

1) Actual spreading time : corresponding to the time necessary to apply a given rate of suspension depending on the driving speed of the tractor and the width of spread.

2) Time for turning : corresponding to the aggregate of the time necessary to turn round.

3) Loading time : corresponding to the sum of following times :

   - preparation of the load
   - actual filling time of the applicator
   - preparation for departure
   - time of empty return

4) Miscellaneous times : corresponding to the unforeseen time losses (for example folding up the booms to avoid obstacles on the ground or during the journey ; check of levels, check of nozzles, etc...)

5) Time of journey : corresponding to the time used to park the applicator at the end of the day

To illustrate the technique used for the analysis, the following data can be given :

1) Rate of application : 1000 kg/ha 5-15-15

2) Tank capacity : 2880 kg

3) Average acreage to be treated : 2.88 ha

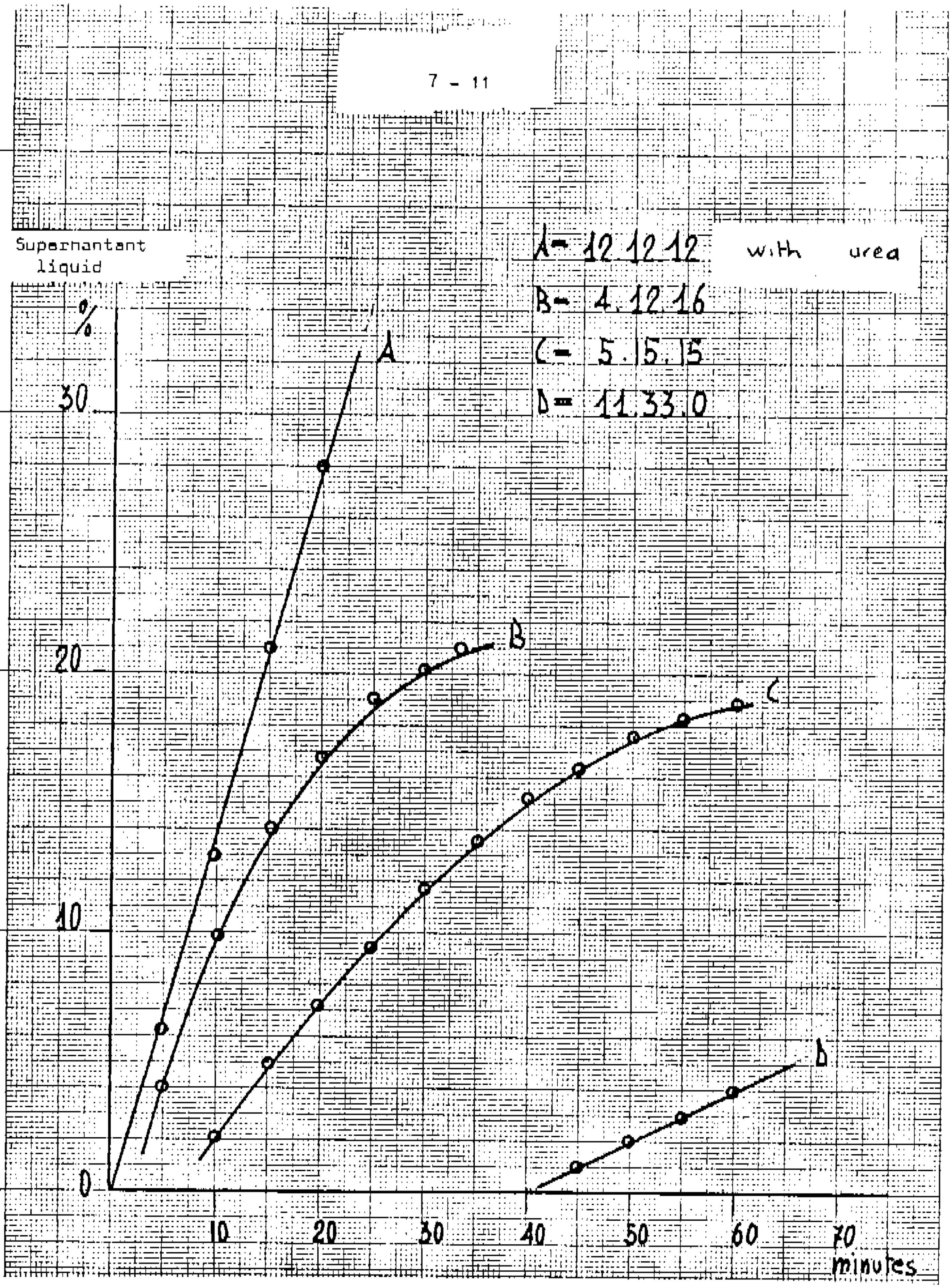
Time per ha : (min. sec.)

		4	6	8	10	12
- Driving speed	km/h	4	6	8	10	12
- Operating time		12 50	8 33	6 25	5	4 16
- Turning time and treatment of edges : 3 turn-rounds at 15 sec. plus 2 edges at 2min+0min45sec. = 2min45sec./2.88		0 57	0 57	0 57	0 57	0 57
- Loading time: Load preparation 2; Actual loading 4; Preparation to loading 2; Empty journey 4	12min/2.88	4 10	4 10	4 10	4 10	4 10
- Time of various operations		1 30	1 30	1 30	1 30	1 30
- Maintenance time: washing time 30; journey 15; = 45						
Acreage per day 30min/ha	45/30	1 30	1 30	1 30	1 30	1 30
Time per ha		20 57	16 40	14 32	13 07	12 23

Time per ha corresponding to a working capacity per hour

km/h	ha/h
4	2.9
6	3.6
8	4.1
10	4.6
12	4.8

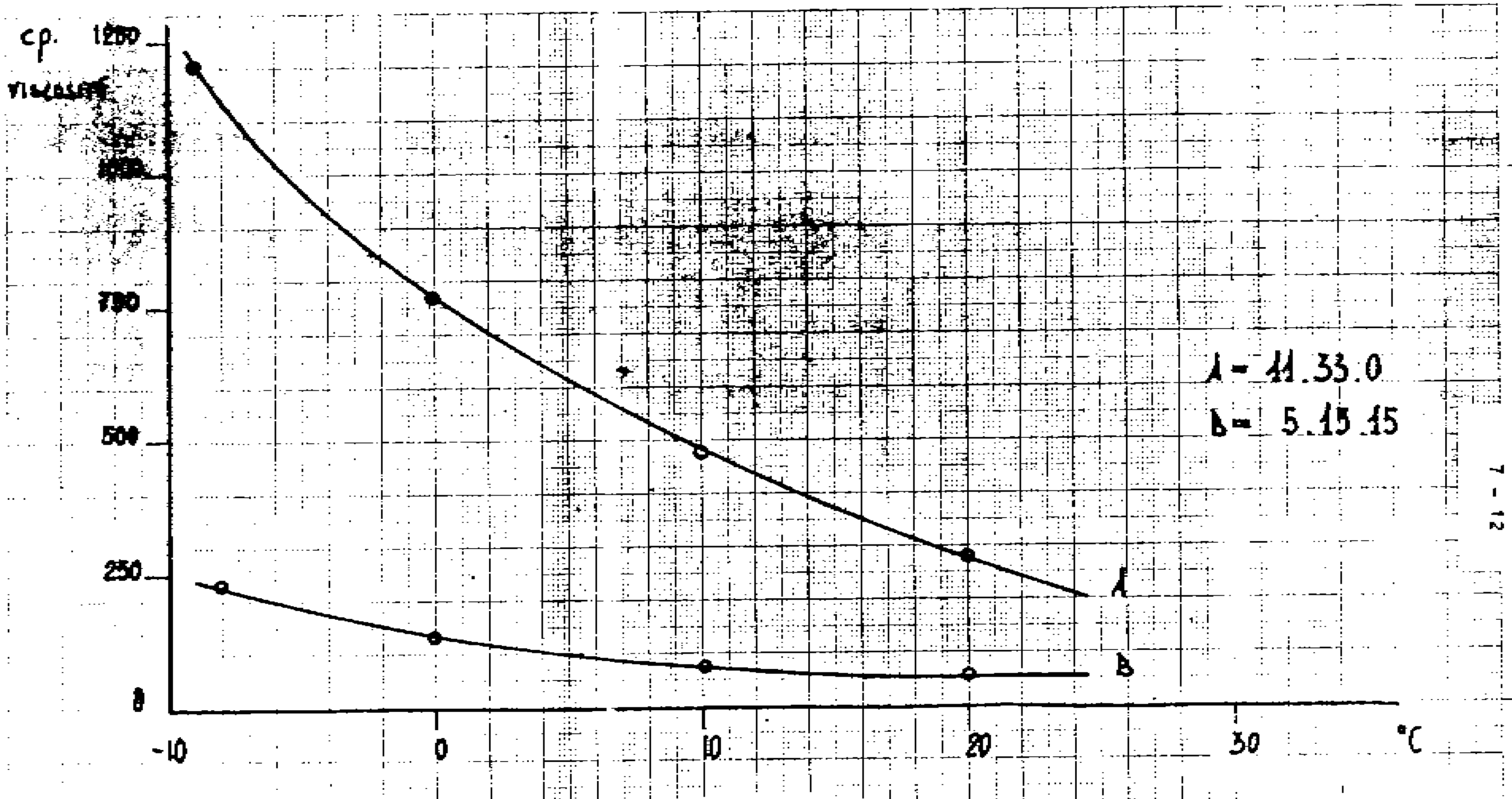
In figures 1A and 2A the above results are reported in graphs. In figures 3A and 4A the influence of the variation of the rate of application per ha on the time taken per ha and on the working capacity per hour of applicators at a constant speed of 8 km/h is reported. The curves on figures 3A and 4A were drawn in the same way as those of figures 1A and 2A.



PRODUCTION AND DISTRIBUTION OF LIQUID FERTILISERS

FIG. 1

Percentage of supernatant liquid owing to centrifugal force
(500 rot./min.)



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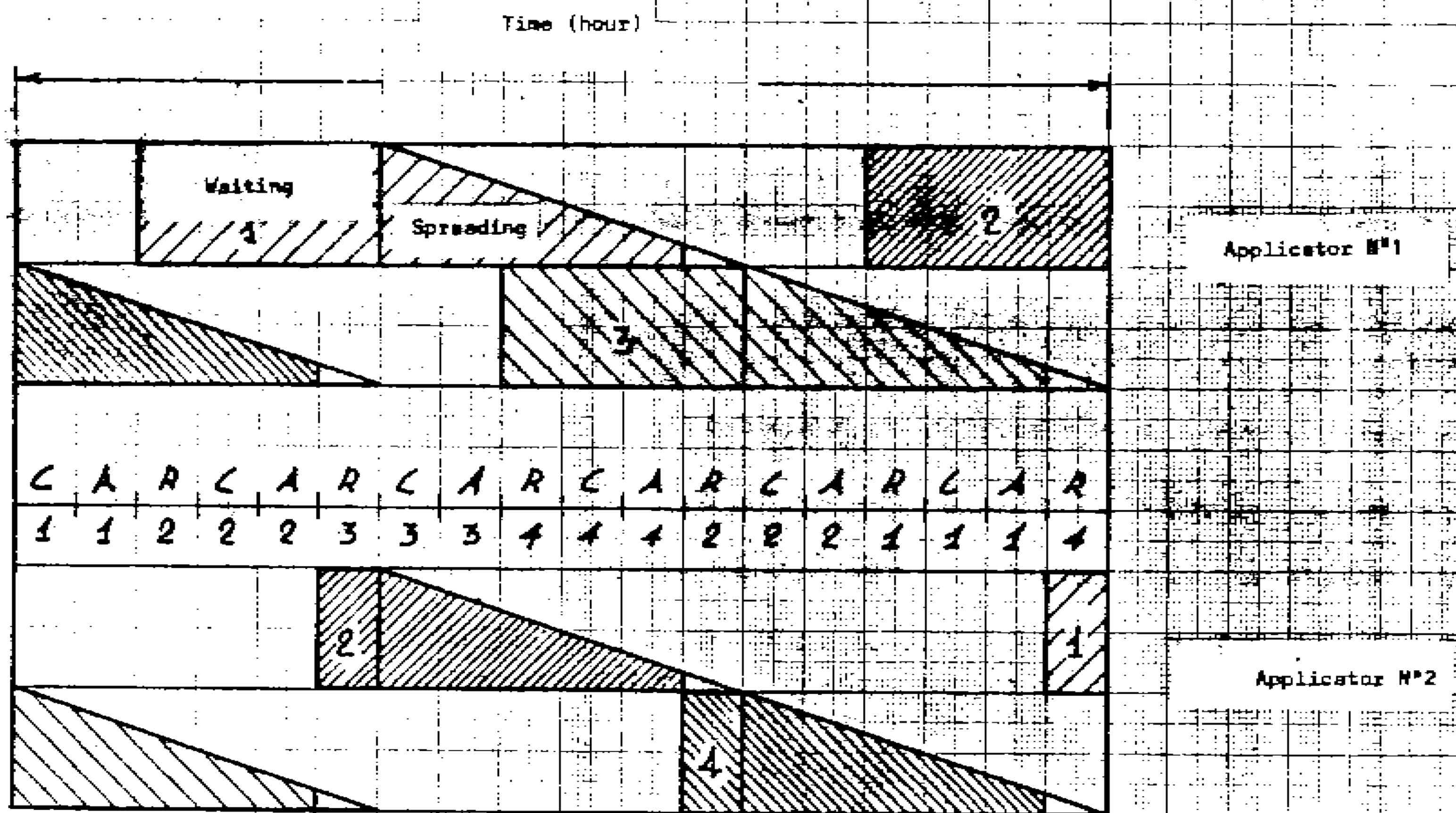
PRODUCTION AND DISTRIBUTION OF LIQUID FERTILISERS

FIG.2

Viscosity as a function of temperature



C = Trailor loading

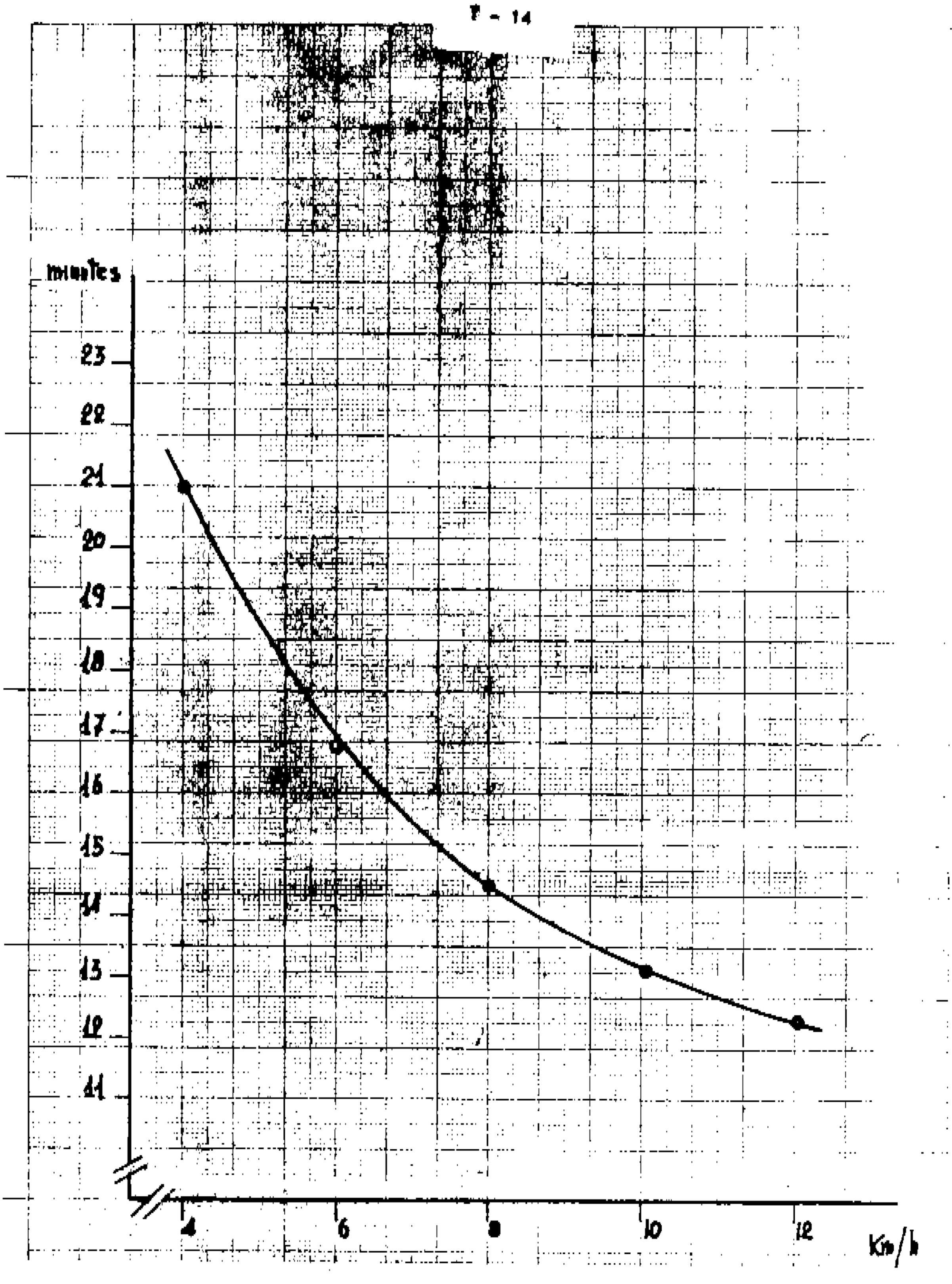
A = Single journey

R = Return journey

PRODUCTION AND DISTRIBUTION OF FLUID FERTILISERS

FIG.3

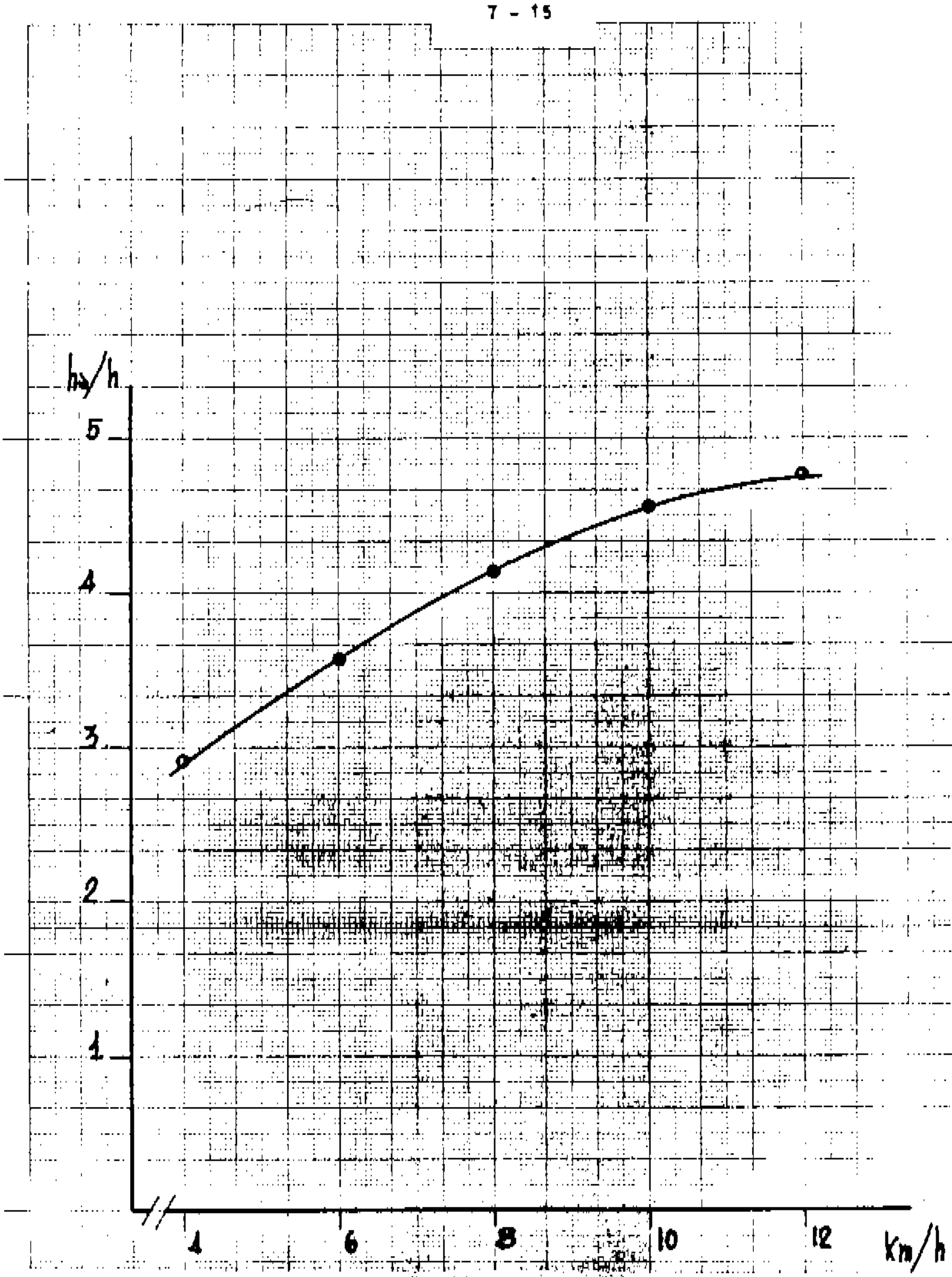
Diagramme of work times for a typical spreading site involving 2 applicators, 1 tractor and 4 trailors.



PRODUCTION AND DISTRIBUTION OF FLUID FERTILIZERS

FIG. 1A

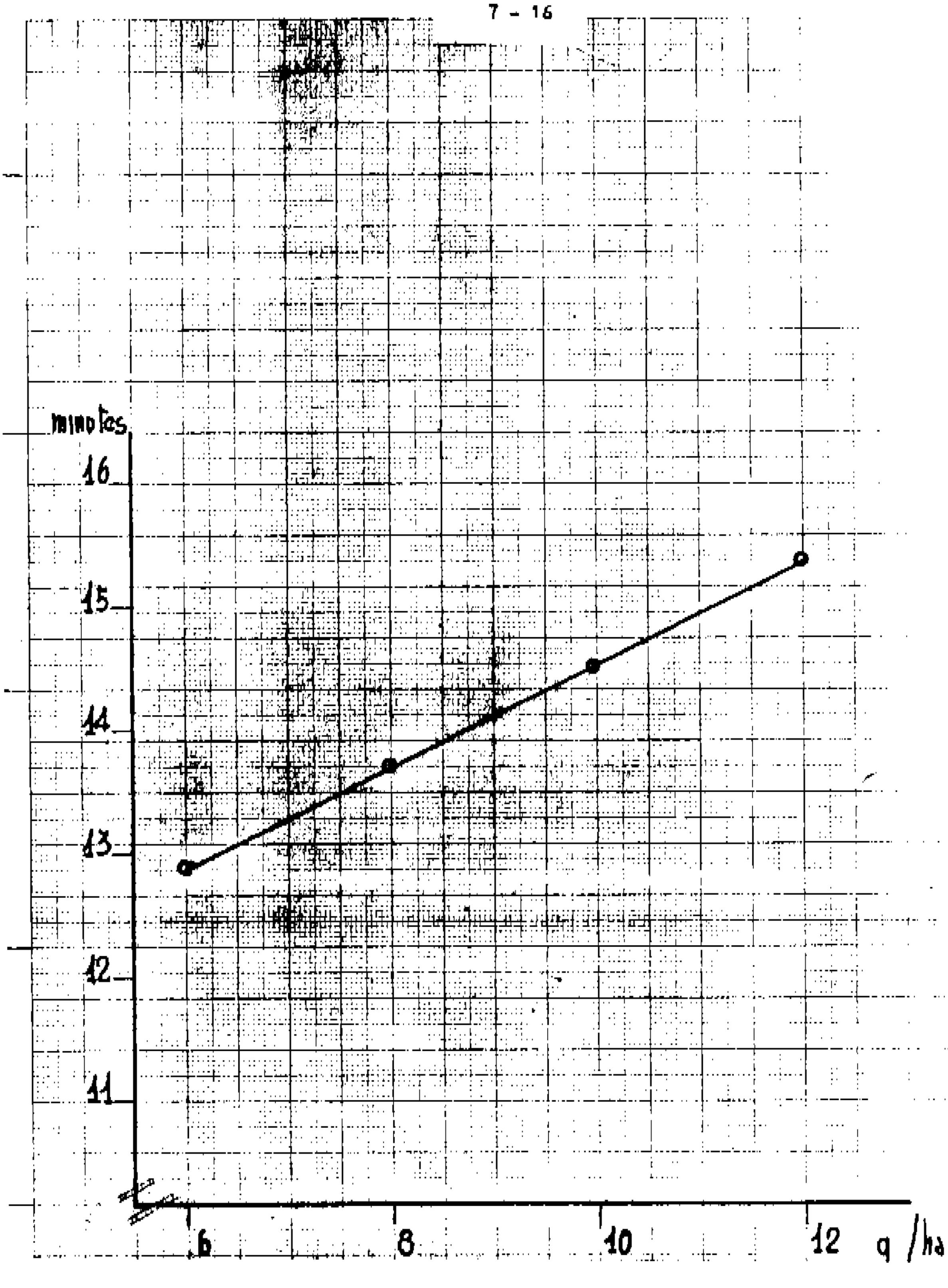
Time necessary per ha (min/ha) according to the driving speed (km/h) at constant application rates. (10 q/ha).



PRODUCTION AND DISTRIBUTION OF FLUID FERTILISERS

FIG. 2A

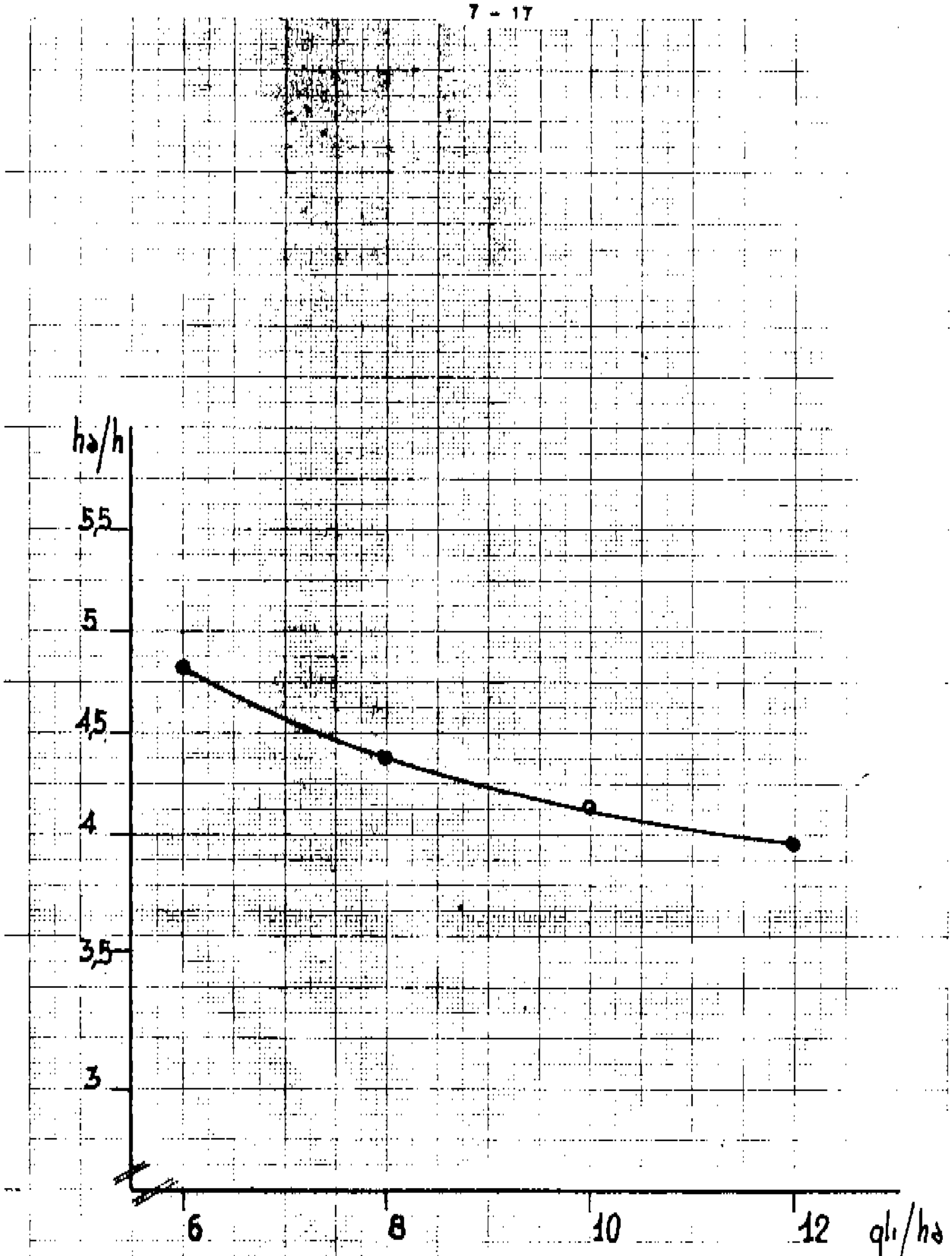
Working capacity (ha/h) according to the driving speed (km/h) at constant application rates (10 q/ha).



PRODUCTION AND DISTRIBUTION OF FLUID FERTILIZERS

Fig. 3A

Time used per ha (min) according to the application rate (q/ha) at constant driving speed (4 km/h).



PRODUCTION AND DISTRIBUTION OF FLUID FERTILIZERS

FIG. 4A

Working capacity (ha/h) according to the application rate (q/ha) at constant driving speed (8 km/h)

DISCUSSION OF PAPERS No 6 AND 7

Mr. FRAITEUR (Soc. de Prayon, Belgium)

The great progress made by fertilisers since the "shovel mixing" time is largely due to fertiliser manufacturers themselves. They indeed tried within the limits set by their techniques, to cope with the increasing request of farmers who wanted fertilisers and especially their application methods to be better adjusted to the increasing requirements of a more productive and human farming. In less than 20 years granular compound fertilisers succeeded straight powder fertilisers, 50 kg plastic bags succeeded 100 kg jute sacks, a frequently high concentration succeeded low contents, more precise spreading techniques succeeded coarse application methods.

But all these improvements, though quite important, did never satisfy the progressive farmer who was still expecting for fertilisers a solution as complete and rational as those found lately for a number of farming operations. In respect of fertilisers improvements were still necessary in handling and application methods.

Soon after 1950 in the US and in 1960 in France, liquid fertilisers with one or two nutrients appeared and studies were undertaken to put on the market NPK clear liquid and suspension fertilisers. As soon as suitable methods were developed for producing and storing economically all nutrients in that form and when all problems associated with the distribution of these nutrients from factory to the field were solved in the best economic and agronomic conditions, liquid fertilisers offered to the customer the main following advantages :

- Even and precise distribution
- Joint fertilizer-pesticide (in particular herbicide) treatments
- Substantial labour saving
- Finally the possibility of a true "tailormade" fertilisation.

After thorough investigations the Société de Prayon arrived at the conclusion that essentially liquid fertilisers were best suited to fit the present needs of an increasingly quickly moving agriculture and we now propose to show you in a few slides what the Company achieved in Belgium especially.

A slide presentation then followed.

Mr. MORANDI (Montedison, Italy)

Mr. Morandi read a great part of paper No 7 sent out in advance to all participants (see text).

Mr. KOTLAREVSKI (Ets. Gardinier, France)

I would like to congratulate Messrs. Fraiteur and Morandi for their clear exposé and I agree with them that liquid fertilisers have a big future, but I regret that the papers do not include any technical-economical comparison between liquid and solid fertilisers and that will be my first question. What is in your opinion the "root delivered" cost of a solid and a liquid fertiliser of the same analysis ? It seems to me that the present price increases of energy and transport should not be favourable to liquid fertilisers.

I would also like to ask a question more specifically to Mr. Fraiteur regarding the neutralization process of phosphoric acid. Mr. Morandi described a very simple and elegant neutralization process of 36% phosphoric acid by ammonia, which is much more interesting than producing polyphosphates which involves an additional complication and additional risks of reversion and decomposition of fertilisers. In addition in the case of Prayon the polyphosphate manufacturing process requires a very pure acid. My question is : what is your opinion on this point ? Would Société de Prayon continue with the polyphopshate route ? Did Société de Prayon try to use acids from phosphates other than Kola, in particular from Morocco and Florida ?

I would now like to ask a question to Mr. Morandi regarding fertiliser spreaders. Mr. Fraiteur explained that spreaders should belong to farmers and not to users. Mr. Morandi said that his company bought the spreaders and does the work for the farmers. Why that difference and how do you explain it ?

Finally I would like to get an explanation from Mr. Morandi about page 5 of his paper. You say that storage properties depend on the P_2O_5 content of the suspension and when the P_2O_5 concentration increases the stability increases. How can you explain that ?

Mr. FRAITEUR

1st question. You asked if we made a technical economical comparison of solid and liquid fertilisers to take account of the increased cost of energy. I must say that we did not do it recently. We did it, of course, before undertaking the production of liquid fertilisers but we have to point out that from the production point of view liquid fertilisers use very little energy as compared to solids since they don't have to be dried. However, in the transport, part of this energy is lost again but at present the procedure is different and there is no problem in that connection. The critical level has not yet been reached.

Regarding your second question which is an opinion on the Montedison process of neutralization of phosphoric acid by ammonia to make suspensions, the best would be to ask Mr. Morandi to answer. However I believe that for the production of suspension fertilisers orthophosphoric acid is suitable. But when highly concentrated clear liquids are to be produced, polyphosphates are necessary; in addition we shall not here consider the agonomic advantages of polyphosphate but it has been shown on a number of occasions that these advantages do exist. As to Prayon, it is true that the superphosphoric acid route is fairly expensive because the raw materials must be pure. At present I can say, in view of the phosphate storage, that most phosphates are treated for making superphosphoric acid which, of course, require the removal of organic matter before entering the superphosphoric acid plant and we have had very satisfactory results. We believe that we shall stick to the superphosphoric acid route because, as you saw this morning in Mr. Meline's paper, it is sure that if, thanks to the T reactor, the maintenance costs of such a plant can still be considerably reduced, a high quality product is obtained.

Mr. MORANDI

Your second question relates to the stabilizing effect of P_2O_5 for suspension. In fig. 2 there is a diagram showing the variation of viscosity against temperature for two formulations, 11-33-0 and 5-15-15. At the same temperature the viscosity for 5-15-15 is about 100 cps and 500 cps for the 11-33-0. The increase in viscosity, according to our experience proves the stability of the suspension.

For the other question we chose the wet process phosphoric acid route to have an immediate production of suspension fertilisers. We also think that with orthophosphoric acid it is possible to get analysis similar to that of solid fertilisers.

Regarding the energy question, solid fertilisers must also be brought to the field and the costs of energy are not comparable. The cost of equipment is quite different.

Mr. JANICEK (Chemistry Institute, Poland)

My question concerns the suspension fertilisers. I would ask you if it is possible to produce them all the year or if the production is limited to the seasons in which they are used in agriculture.

Mr. MORANDI

In our case production is limited to the season of application.

Mr. FRAITEUR

In fact fertilisers are produced mostly during the season of application and in Belgium production can last from the end of February-beginning of March to the end of September.

Mr. WHITEHURST (Texasgulf, U.S.A.)

The production of 10-34-0 and the conversion of that material into by 5-15-30 suspension is carried on on a year-round basis in the United States.

Mr. DAVIS (Tennessee Valley Authority, U.S.A.)

Questions for Mr. Fraiteur. I wonder if he had found in his attributions certain advantages to attain the high polyphosphate levels of 75-80% of the P_2O_5 as described in Mr. Meline's paper early this morning.

Mr. FRAITEUR

Concerning the production of ammonium polyphosphate, our market is not confined to Belgium which is a fairly small agricultural area but extends on all the EEC countries and even elsewhere so that our output is about the same all the year round and we have fairly long storage periods. Thus we want to have as high a conversion rate as possible for our products so that they have good storage properties. It is then desirable for us to have a very high polyphosphate level in our polyphosphate solution owing to the way we use it.

Mr. MELINE (Tennessee Valley Authority, U.S.A.)

I would like to make the comment that the 10-34-0 solution is made the year round in the United States and stored until the period of use primarily in the fall and early spring and with the high polyphosphates there are no problems and the need for producing year round originates from the fact that the wet process superacid is of limited availability, so they have to take it on an allocation year around and they would rather store it. It is cheaper to store the liquid fertiliser than the superacid.