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**TAILOR MADE LIQUID NPK FERTILIZERS -
A UNIQUE PRODUCTION, DISTRIBUTION AND APPLICATION METHOD
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RESUME

Il existe une utilisation croissante de micro-irrigation et de fertigation dans le monde. Les engrais liquides sont la forme la plus sophistiquée et la plus adaptée d'application d'éléments nutritifs par le système de fertigation. Deshen Gat fournit à l'exploitant une formule d'engrais liquide sur mesure selon les besoins agronomiques, l'agrotechnologie et l'économie de la culture.

La méthode Deshen Gat repose sur 3 facteurs :

1. Un système souple de production capable de fabriquer n'importe quelle formule avec un temps minimum de stabilisation ;
2. Un système de distribution qui fournit le produit n'importe où dans un bref délai
3. Une équipe d'agronomes qualifiés qui apporte à l'exploitant conseils de fumure et assistance technique.

Le contact direct et la relation personnelle entre l'exploitant, l'usine et les agronomes est la clé de la réussite du système Deshen Gat.



1. INTRODUCTION

The need for intensified yet environmental friendly agriculture, leads to an ever increasing use of micro irrigation and fertigation - applying plant nutrients through the irrigation systems.

Fertigation is required when implementing micro irrigation such as drip or micro sprinklers since it is necessary to provide an optimal flow of water and nutrients into the reduced active root zone.

Fertigation allows to target the plant roots with the right amount of water and nutrients to meet the specific crop demands according to the growth phase of the plants. High yields are achieved while there is an efficient utilization of water and plant nutrients. Fertigation prevents excess inputs of fertilizers and a better control of the wetting depth. Leaching of nutrients below the root zone is reduced and ground water contamination is minimized.

Liquid Fertilizers are the most advanced and convenient plant nutrients for application through fertigation systems. A tank containing the concentrated fertilizer solution is placed in the field, orchard or greenhouse and the solution is accurately pumped during the irrigation session.

Liquid Fertilizers may be also used for pre-plant base dressing of field crops via a liquid fertilizer applicator or a sprayer. The method ensures a more accurate application, reduces labor, dust and waste.

The higher yields, the efficient utilization of nutrients, the reduction in labor expenses and the convenience justifies the higher price of liquid fertilizers versus the price of conventional fertilizers (10-15%).

Israel became a pioneer in the utilization of fertigation and liquid fertilizers due to the limited resources of irrigation water and the need for intensified agriculture. Most of the orchards vegetables and row crops in Israel utilize micro irrigation and fertigation. About 65-70% of all the nutrients applied in Israel are applied as liquid fertilizers.

Deshen Gat provides its clients with tailor made products. The company is committed to provide liquid fertilizers:

1. at any ratio between nitrogen: phosphorus: potassium: calcium: magnesium and micro elements and in accordance with the specifications of the product
2. at any quantity (above a minimum of 500 liter)
3. at a minimal supply time (max of 12 hours from order)
4. at any location within the supply zone of the factory (a radius of about 150 km).

The Dashed Gat system will be described in the following order:

1. The raw materials and products
2. The production and quality control
3. The logistics
4. The marketing and agronomy.

2. THE RAW MATERIALS AND PRODUCTS

Besides the content of macro and micro elements the grower may request various other specifications such as formulas without urea, chlorine free, with a specific $\text{NH}_4:\text{NO}_3$ ratio, with a specific pH, with a specific content of sulfur, etc.

A range of raw materials are utilized in order to achieve the various specifications of the tailor-made products. The raw materials are normally soluble salts of high quality and purity or raw liquid fertilizers such as phosphoric acid or ammonia.

The products of Dashed Gat were divided into families according to the target crops and the raw materials content:

*Liquid fertilizers for fertigation of greenhouses, soilless culture and intensive vegetable crops (« Shafir »). Clear liquid NPK solutions with optional micro elements. The solutions are chlorine and urea free and the ammonium:nitrate ratio is low. The raw materials used are: ammonium nitrate, phosphoric acid, monoammonium phosphate and potassium nitrate.

*Liquid Fertilizers for fertigation of intensive crops and orchards (« Low Chlorine »). Clear liquid NPK solutions with a low chlorine content (not more than 3%). The Low Chlorine solutions are mainly used for fertigation of intensive crops and orchards. The raw materials used are: ammonium nitrate urea, uran, phosphoric acid, monoammonium phosphate, potassium chloride and potassium nitrate.

*Liquid Fertilizers for fertigation of vegetables, field crops and orchards (« Ilit » and « Tuv »). Clear liquid NPK solutions. The Ilit group contains urea nitrogen while the Tuv group contains ammonium nitrate. Both groups contain phosphoric acid and potassium chloride.

*Liquid Fertilizers for pre-plant base dressing of field crops (« Bar »). Concentrated liquid NPK solutions for application via a liquid fertilizer applicator or a sprayer. The raw materials used are: uran, ammonium polyphosphate and potassium chloride.

*Liquid Chelated Micro elements. Various high quality liquid nutrients including: « Ferogat » - chelated iron, « Zincgat » - chelated zinc and « Microgat » - chelated micro element cocktail.

3. PRODUCTION

The manufacturing of tailor made liquid fertilizers demands a special production system that is versatile, flexible, quick and accurate in a wide range of batch quantities.

The production process commences with dissolving soluble fertilizers to create and store « mother solutions » in storage tanks. Upon receiving an order the appropriate rate of mother solutions are blended in a reactor and loaded into a tanker (tank on a truck) that distributes the liquid fertilizer to the client. (Figure 1)

The production of mother solutions takes place in reactors equipped with heating and stirring properties. Soluble fertilizers are loaded into a hopper and are elevated automatically into the reactors. This production process is computer controlled and almost fully automatic.

An example of the production of the mother solution « liquid urea 21-0-0 »:

The 15 m³ reactor is filled with a measured amount of warm water (about 40°C). Urea is gradually poured from the hopper through the elevator into the reactor while stirring takes place. Since the dissolution of urea is endothermic (temperature falls), the temperature in the reactor is kept constant by heat exchangers and by controlling the amount of urea inserted. The reactor is equipped with an electronic scale and temperature meters to measure the materials and monitor the temperatures. The materials used for the production of 1 ton liquid urea: 540 kg water and 460 kg urea 46%.

The final blend occurs near or upon the arrival of a tanker. Mother solutions are blended in a reactor in accordance with the compatibility and the specifications of the final product. The product is loaded immediately into a tanker.

This production process is computer controlled, fully automatic and is executed by one operator. Thousands of formulas of the final products are stored in a data base in the computer, and when producing an order the operator only inserts the code and quantity of the requested formula.

An example of the production of « Shafir » 7-3-7:

The following mother solutions are poured into the reactor:

- liquid ammonium nitrate 21-0-0	222 kg/ton
- liquid phosphoric acid 0-54-0	56 kg/ton
- liquid potassium nitrate	583 kg/ton
- water	139 kg/ton

The blend is stirred filtered and loaded into a tanker for distribution.

Quality control consists of a preliminary check of color, pH, specific gravity and clarity. Samples from the production of mother solutions and final products are analyzed regularly in the lab for the content of urea, NH_4 , NO_3 , P_2O_5 and K_2O .

When a new liquid fertilizer formula is requested by a client it is tested in the lab prior to production. The test will be conducted in accordance with the working environment of the target grower.

The parameters tested are:

- the crystallization (salting out) temperature of the formula
- the compatibility of the formula with the irrigation water
- the effect of the formula on the chemical qualities of the water (i.e. pH and electrical conductivity).

4. LOGISTICS

A grower using liquid fertilizers must equip himself in the field with tanks to store the product. The volume of the tank depends on the size of the plots. For fertigation it is recommend to have a storage capacity sufficient to last 2-4 weeks. The application of pre plant liquid fertilizers takes place a few days in the beginning of the season. We recommend a intermediate tank to fill the applicator or sprayer daily.

The distribution system of liquid fertilizers to the clients consists of a fleet of tankers (trucks with a tank) in various sizes in accordance with the requested quantity and the transferability in the field or orchard. Normally the tank on the truck is divided into a few compartments.

The delivery of the liquid fertilizers is done directly from the factory. The client orders the product directly from the production operator. He specifies the formula, quantity, and location and coordinates the delivery date and time.

The production operator plans the delivery schedule and assures efficient tours of the tankers together with an excellent and accurate service.

5. MARKETING AND AGRONOMY

« Tailor-Made Liquid Fertilizers » is a marketing idea that responds to the problems and actual needs of the growers.

The grower may order any liquid fertilizer formula according to:

- The agronomic needs (depending on the crop, soil fertility, climate, season, method of application and other factors)
- The specific logistics and agrotechnology utilized by the client
- The economics of the crop.

The utilization of liquid fertilizers is the most sophisticated method for supplying nutrients to the plants. It is relatively a new technique that requires wide agronomical knowledge and specialization. The sales and agronomic team provides the grower with the professional support by assisting with fertilization recommendations, agrotechnical solutions and various technical assistance.

« Direct marketing » is an integral part of the systems success. The client is in direct contact with the factory coordinating his order and delivery and in direct contact with the company's team of agronomists. The direct contact and intimate bond between the grower, the factory and the field agronomists is the key to the success of the Deshen Gat system.

Figure 1

Liquid Fertilizers Production Process in Deshen Gat



