Manufacturer of Blending, Bagging and Transport equipment

Customer-Specific Blending

Zico Zeeman, EMT, the Netherlands, shows how customer-specific fertilizer blends can assist farmers with maintaining or increasing yields while using less fertilizer, and describes the installation of a blending factory in Topolobampo, Mexico.

With the enormous increase in prices for raw material inputs in the agricultural sector, everyone is searching for smarter ways to decrease the use of these raw materials but still increase yield per hectare. The fertilizer industry in particular is being hit hard by shortages of various raw materials due to high gas prices and the Ukraine conflict. What is the solution for fertilizer suppliers who are seeing their fertilizer prices skyrocket but want to help their customers achieve their required output?

The best solution is to start controlling the farmers' nutrient requirements. What nutrients do the crops require and what nutrients does the soil offer? Finding out any discrepancies between these two is the first step to lowering farmers' required fertilizer input.

The second step is addressing this discrepancy with the correct types of fertilizer to ensure the crops have their required nutrients without farmers over-fertilizing their fields. Unfortunately prefabricated NPKs often do not contain these exact required nutrients, and applying them to the crops means either over-fertilizing the field or underfeeding the crops.

Instead, applying a specially prepared blended NPK fertilizer is the solution. For farmers, the benefits of this specific blend, despite the often higher price, outweigh the costs incurred through over-fertilization or the lower revenue as a result of incorrect nutrient availability.

Figure 1. Vertical blender.

Figure 2. Rotating blender integrated into a continuous line.

Figure 3. Paddle blender and big bag line.

Figure 4. Continuous blender.

Suppliers that know the specific target market requirements and can fit their fertilizer offerings to these needs will help their customers to achieve their required yield by using fewer tonnes of fertilizer, saving costs on fertilizer input while keeping revenue steady or even increasing revenue from the extra farm output.

To prepare these customer-specific blends and then bag them so that they can be handled and made available to the customer, a couple of machines are required. The following sections will elaborate further on these specific machines and their pros and cons.

Software calculation program

EMT has developed different software packages, such as Optiblend, to make cost-effective calculations for fertilizer blending. This is an optimisation program and can help the customer/dealer to make the right formulations against the lowest costs. In addition, a complete product analysis can be calculated, including the NPK value but also all required micronutrients. The program helps to calculate the right raw material that can be used for the blending process. In the program it is possible to add the nutrient value of crops, organic fertilizer, soil quality, manure and mineral fertilizer. Then, a field hectare or acre calculation based on the farmer's information can be made, so that the farmer receives the correct amount of fertilizer. Through the use of the Optiblend program, in combination with a blender system, the correct quantity of fertilizer will be spread onto the field, which will reduce costs and environmental pressures.

Blending units

To make the final blend, various types of blenders are available; they can be separated into two specific groups: batch blenders and continuous blenders. Batch blenders consist of the types of blender that work in batches, normally varying from 2 to 16 t per batch. Each batch blender works in cycles, starting with a filling stage with weighing of each raw material, followed by a blending stage and then discharges. The capacity normally ranges between 20 and 70 tph.

Vertical blender

The blending principle of the vertical blender is based upon a conical screw inside the container that blends raw materials in a wave motion, while always ensuring accurate weighing of the product by never suspending any product. The bottom cone of the blender has a 60° angle to eliminate product build-up inside the container. A salem valve on the bottom of the blender, coupled with a sweep on the bottom of the auger, ensures complete cleanout of the blender. The machine can reach a capacity of 60 t/m^3 per hour. The complete system is mounted on a digital weighing system.

Horizontal rotating blender

Various branches of the industry have horizontal rotating blenders in operation. The blending process is simple: the turning drum has internal flighting that blends the different raw materials in a folding action. The resulting blend has excellent homogeneity, with little or no degradation or segregation.

The blending capacity varies from 2 t, with a capacity of 2 m^3, to 10 t, with a capacity of 10 m^3. The weigh hopper has the same capacity as the blender and is mounted on a digital

weighing system. The weighing and blending processes are separated in this type of blender.

Paddle blender

Different types of paddle batch blenders can be installed. The paddle blenders are well-suited to blending granules but also to blending powdery material, such as water-soluble fertilizer. The twin shaft high-speed paddle mixer is ideal for this type of material. Both shafts run in opposite directions at high speeds and can mix the powdery material with ease. These types of blender usually reach 1 to 4 t per batch.

Continuous blender

Continuous blenders, on the other hand, work continuously and can be filled and discharge simultaneously. The material is blended by a blending screw and capacities can go up to 250 tph.

This blender operates with modern technologies. The computer commands and controls the entire continuously operating weighing blending process by means of a variable electro system. This guarantees an optimum quality.

The system works as follows: the operator fills the hoppers with raw materials by using a wheel loader or forklift with a bucket. Each hopper is mounted on a digital weighing system; the stainless steel dosing conveyors, in combination with the digital weighing systems, ensure the proper dosing of raw materials. This system has a blending capacity of 20 – 250 t/m^3 per hour. The number of hoppers is unlimited. The complete blender is made of stainless steel with a hopper capacity of 4 – 15 t/m^3.

Adding micronutrients, inhibitors or additives

Both groups of blenders can be used to add micronutrients, inhibitors or additives to the blend. It is important to know which types of product need to be added to the blend to make the product more valuable for customers. Depending on these considerations, it may be worth installing a powder-adding unit or a liquid-adding unit in the blender.

Intermediate handling

After blending the material, or sometimes before, it might be interesting to condition the fertilizer, depending on the quality of the raw material provided. Screening might be a good option in order to remove dust or large foreign particles from the blend to ensure a good final homogeneous blend. Another option is to add fertilizer conditioners, such as lump breakers, into the machinery. This can be done for one specific type (for example urea) or for the complete line.

After the material is blended it is customary to transport it directly to the bagging units. In a set-up like this handling of the material is minimised. Different bagging units can be installed behind one blending unit; again this greatly depends on the required output. Two types of bagging units can be distinguished: big bag filling units and small bag filling units.

Big bag (FIBC) filling unit

This stainless steel bagging unit is designed to fill FIBC bags with a range of 250 to 1500 kg. The possible height and capacity that is available are important factors when choosing the type of bagging unit. Weighing above the bag requires more height but can result in filling speeds of 70 bags of 1000 kg per bag per hour or 120 bags of 500 kg per bag per hour.

Figure 5. Liquid impregnation systems.

Figure 6. Small and big bag line.

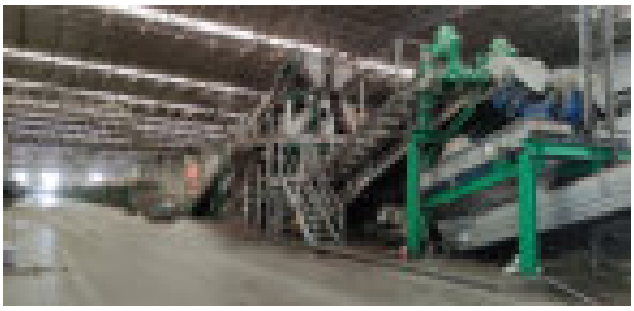

Figure 7. ISAOSA blender and screen line.

Figure 8. ISAOSA urea coating line.

Weighing the product in the bag requires less height but also decreases the filling speed compared to weighing above the bag: 40 bags of 1000 kg per bag per hour or approximately 70 bags of 500 kg per bag per hour.

Small bag filling unit

This bagging line is a unit that can process a maximum of 1000 – 1100 bags of 25 – 50 kg per hour. These rates are achieved by using a double bagging unit. The single bagging unit has a capacity of 500 – 550 bags per hour. Both machines can be equipped with either an open mouth or ventil bag filling system. A combination of these systems is also available.

Case study

In 3Q21, EMT completed the installation of an advanced fertilizer blending factory. The machines, now located in the port city of Topolobampo on the Gulf of California in Mexico, were produced in the Netherlands and shipped in 25 x 40 ft high cube containers to the end user, Insumos y Servicios Agrícolas de occidente S.A. de C.V. (ISAOSA). Installation of the factory commenced in 4Q20 and was finished in July 2021.

The complete machine is more than 200 m in length and is designed to run at a capacity of 300 tph. This capacity is achieved by running two lines in parallel to one another – this ensures the blend quality is high and filling of the machine can be achieved by multiple front loaders simultaneously.

In line with the latest developments in fertilizer treatment, direct urea coating and blending has been implemented. A conditioner that breaks up any lumpy urea material is installed above a direct blending screw with a liquid injection point. By weighing both the urea conditioner and the liquid-adding unit the flow of both materials is constantly monitored and adjusted to ensure the end product is exactly as required.

The material is received on the central conveyors and other weighing hoppers dose any extra required material directly on top of the inhibited urea. In this way the inhibited urea can be directly incorporated into a blend with other products. A total of 12 dosing hoppers and six liquid-dosing units are incorporated per line. Another blending screw ensures that all products are properly mixed before they are directed over a coarse screen. A fine screen, which can be bypassed, can be used to sieve dust out of the blend.

The final product is transported to one of the five stainless steel bulk hoppers, with a capacity of 30 t each, or directly onto the train filling shuttle conveyor. This conveyor can move over the outer fence of the compound to fill trains positioned on the railroad directly next to the production facility. Once the train is full the conveyor can be retracted to rest inside the compound.

The complete blend line is computer-controlled and can be operated by one person from the central office. With this machine line, ISAOSA can triple its annual production to a capacity of 300 000 tpy.

Besides the granular fertilizer blending plant EMT is also installing a second blending facility at the ISAOSA warehouse. This unit is solely engineered to blend various water-soluble fertilizers into the required recipes. This machine line consists of 11 weighing hoppers that can be filled with big bags, bulk, or small bags. Again, the product is screened for large lumps and liquid can be added in the blending screw. A shuttle conveyor can discharge the material into three different bagging units for either small bags or big bags. WF