TRENDS IN BULK BLENDING WORLD WIDE

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Assuming that the goal of any fertilization program is basically "to produce the best crop yield consistent with long term agronomic planning at the most economical cost." Bulk Blending offers a very practical and cost effective supply alternative.

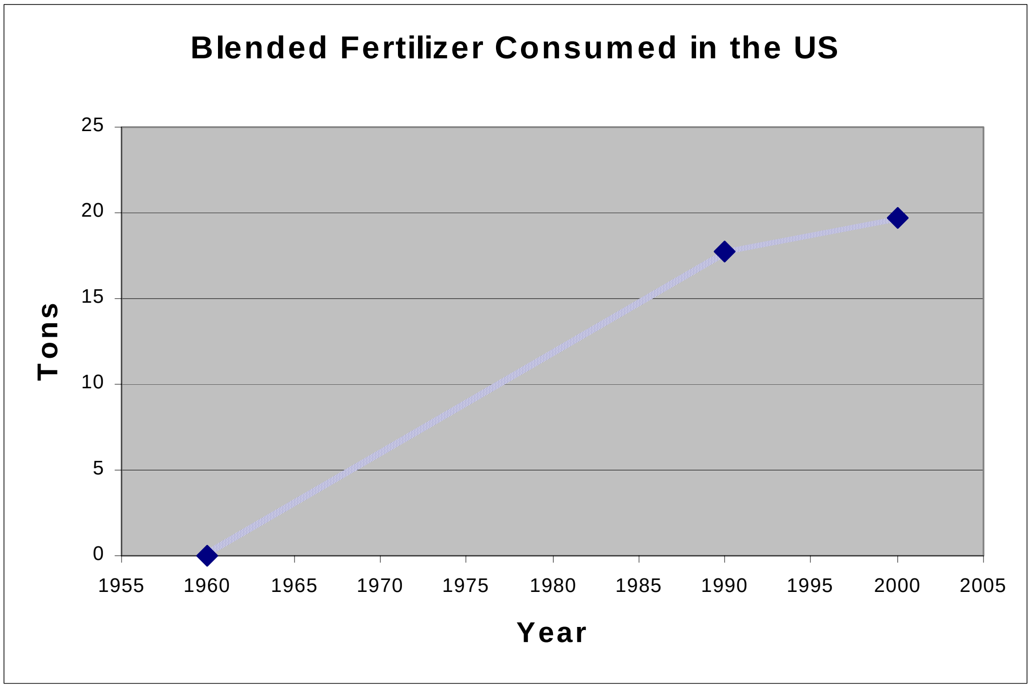
Production alternatives for the preparation of granular compound fertilizer containing two or more of the primary nutrients can be divided into two major categories:

A. Physically mixing various proportions of granular materials to obtain a desired nutrient ratio concentration. Such processes do not alter the physical and chemical characteristics of the granular materials.

B. Processes that require chemical reaction, liquid addition, or melting of some or all of the ingredients to form a granular product.

Actually, the physical blending of fertilizers was the predecessor to chemical granulation. In early bulk blending operations, only powdered or finely divided nitrogen, phosphorus, and potassium materials were available. With the development and use of semi-granulation process during the period between 1950 and 1960, many of the problems associated with the use of powdered material were significantly decreased. Semi-granulation technology was later advanced to the continuous process used to produce most granular fertilizer today. Compound fertilizer preparation rapidly evolved into a highly complex engineering operation. As such, its economics depended on large scale operations.

The large growth and availability of granular products set the stage for the emergence of bulk blending as the major production alternative for supplying granular compound fertilizers to the United States farmers. Today, there are approximately 6,000 bulk blending plants in the United States. Bulk blends account for approximately 70% of the solid compound fertilizers sold in the United States today.



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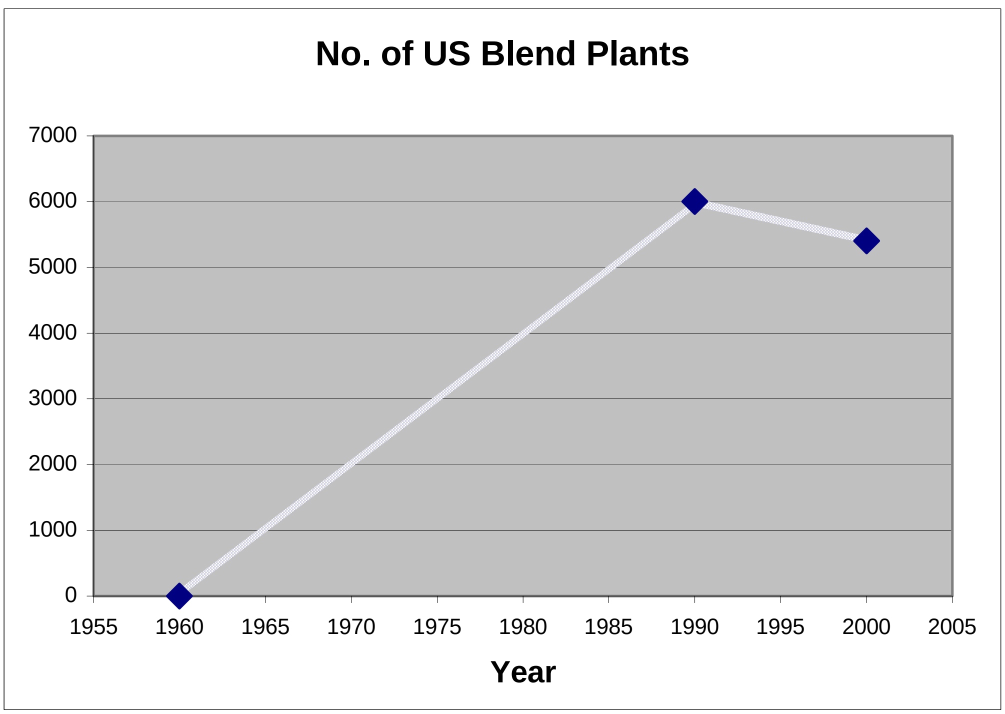

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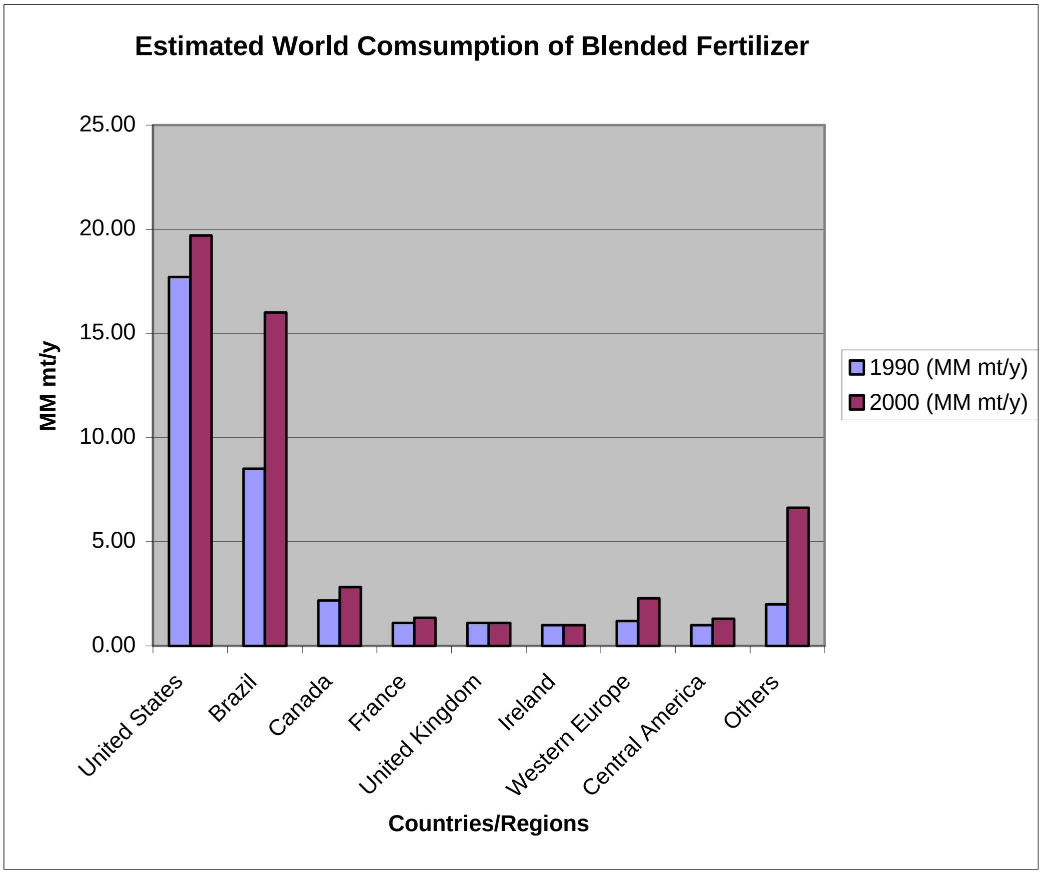
Although the transition to bulk blending has not been so pronounced in other parts of the world as in the United States, the trend toward bulk blending has been steadily increasing. Furthermore, bulk blending is expected to be the first production alternative selected in many developing nations.



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The primary reasons for the growth of bulk blending may be summarized as follows:

COST

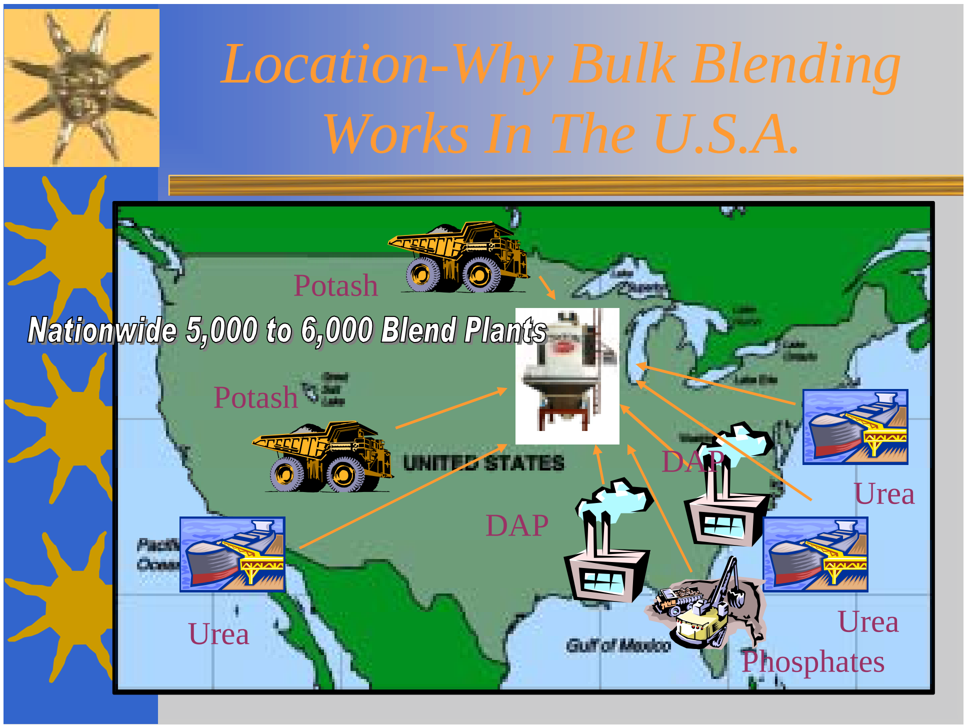
If a significant production cost advantage for either process can be obtained, it should be due to the cost of raw materials since they represent about 60% to 70% of the total production cost. In many cases, all raw materials must be imported and the cost of granular material for bulk blending may be equal to or less than those for chemical granulation. Obviously, this depends on many variables and is not predictable from year to year. However, bulk blending has a marked advantage over chemical granulation in terms of the required capital investment. The capital cost of a 100,000 metric tons per year chemical granulation complex designed to produce compound N.P.K. fertilizers from imported ammonia, phosphoric acid, sulfuric acid, ammonium sulfate and potash would be 3 to 4 times more than the cost of a bulk blend plant designed for the same capacity. A study by International Fertilizer Development Center (IFDC) in 1981 indicated that considering material cost at that time and all plant operating costs that a saving of about $1.00 per unit of nutrient could be realized through bulk blending versus chemical granulation. There is also a significant energy savings in a bulk blend plant versus a chemical granulation plant. Studies done by IFDC indicate a saving of about $3.00 per metric ton of product produced for electricity and fuel in a bulk blend plant versus a chemical granulation plant. We are all well aware that material prices fluctuate quite drastically. However, prices of raw materials have often resulted in a lower finished product price for materials alone in bulk blending versus N.P.K. granulation.

SIMPLICITY

From a process and operating viewpoint, bulk blending is much simpler than a chemical granulation plant. There is considerably less equipment in a bulk blend plant and it requires less expertise to operate and less maintenance to keep running. Whereas, a chemical granulation plant requires equipment designed to deal with chemical reactions and precise metering; a bulk blend plant only requires a precise scale system and efficient mixer to ensure the production of a good product.

LOCATION
Because bulk blending units are relatively inexpensive to install and simple to operate, several small units can be located at strategic locations near consumption areas, thus offering a more reliable supply of fertilizer to regions that may be distant from a large granulation complex. The higher cost and the more complex mechanical and technical nature of the chemical granulation units do not make the installation of several small granulation units practical.

This being the case, fertilizer can be produced at the source of the raw material and the fertilizer can be used at the location of the consumer. For example, urea plants are located at the cheapest sources of natural gas, DAP plants are located at the cheapest sources of phosphates and usually also natural gas and ammonia and potash is compacted near the mines. This way the producers of these materials can maximize their efficiencies and minimize costs. These materials can then be shipped and/or trucked to warehouses where they will be blended or trucked to local blenders. Increasing incorporation of bulk blending has proven this system.



QUALITY

The widespread acceptance of bulk blending has been largely due to the production of good quality products that rival the best chemically granulated products. For many years the quality of bulk blends was debatable, primarily due to the availability of granular material of compatible size. In order to produce bulk blends of a good quality, certain steps must be followed:

A. Raw materials must be closely matched in particle size. This is probably the most critical factor in the production of good bulk blends. Most commercially available granular fertilizer materials used today for bulk blending are in the size range of minus 6 plus 16 mesh (Tyler).

B. Materials should be chemically compatible to prevent them from reacting with each other.

C. Weighing and mixing systems are extremely important and should be designed properly.

D. Transportation and storage systems should be designed to minimize segregation.

Bulk blends are made from high quality granular materials, such as, D.A.P., urea, and potash, and if additional elements are required, it is simply a physical mixing, not a chemical reaction required. Therefore, none of the agronomic effectiveness is lost in a bulk blend. On the other hand, compounds are sometime over ammoniated (losing water-solubility), and when secondary or micronutrients are added, the resulting chemical reactions may reduce the agronomic value of the fertilizer.

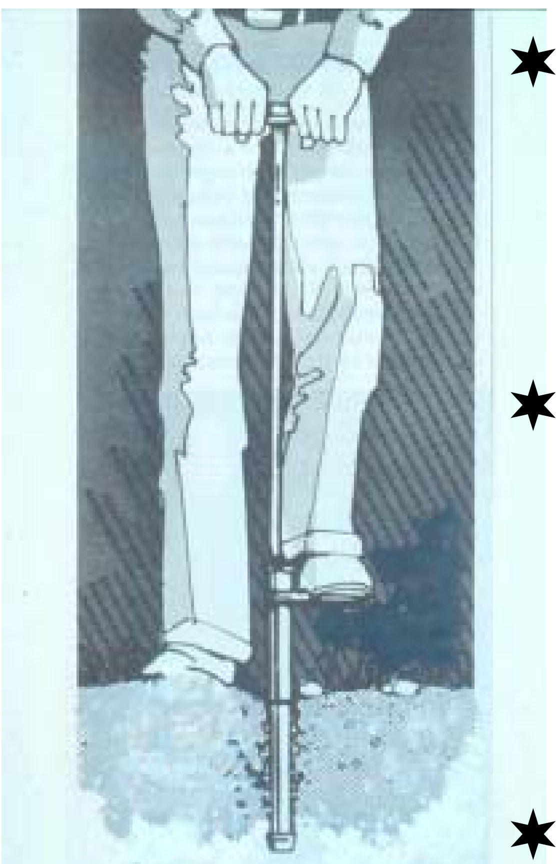
PRODUCT FLEXIBILITY

Since bulk blends are not subject to the process restrictions associated with chemical granulation, a large number of nutrient ratios can be made from a few granular raw materials, such a urea, diammonium phosphate, and potassium chloride. Examples of some of the nutrient ratios and grades that can be made by using these three raw materials are:

Examples of Grades of Bulk Blended Material

Nominal Nutrient Ratio	Maximum Grade Wt % N	P_2O_5	K_2O	Quantity of Material Required Per Metric Ton of Product, kg* Urea	DAP	KC1
1:1:1	19	19	19	261	418	321
1:1:3	11	11	35	159	255	586
1:2:1	15	30	15	75	669	256
2:1:1	26	13	13	482	293	225
2:2:1	22	22	11	310	499	191
3:1:1	31	10	10	601	226	173
4:1:1	33	8	8	676	184	140

A. Material Analysis Urea 45% N DAP 18% N and 46% P_2O_5 and KC1 60 K_2O



- Growers are having their soil tested annually for nutrient levels.
- The results of those tests help the grower and blend plant manager decide what blend to apply.
- Regulations on over application of nutrients

In addition to providing the traditional N.P.K. nutrient requirements, bulk blends are well suited for incorporating micronutrients. Bulk blending provides the means by which a local plant can provide varying fertilizer grades to satisfy the specific needs of the local farmers. As agronomic techniques become more sophisticated and more widespread, the need to respond to specific crop requirements has become increasingly important. Where chemical granulation can typically provide from four to ten grades from one installation economically, the number of grades that can be offered from a bulk blend plant are almost limitless.

Product flexibility is especially important in developing regions because sufficient crop response data are usually not available to make a reliable prediction of the long-term nutrient requirements necessary to justify the installation of a relatively inflexible chemical granulation plant.

Bulk blending has become popular as a method by which a local plant can provide varying fertilizer grades to satisfy the specific plant needs of the individual farmers with relatively simple and inexpensive equipment. The granular materials produced by the large manufacturer are shipped in bulk to the plants that generally provide the finished N.P.K. product to their customers in bags. Bulk blending appears to have much in its favor with lower capital investment and virtually no process restrictions allowing the production of more ratios that are economical to produce in almost any quantity. There factors make bulk blending the most feasible production alternative for compound fertilizers in many countries.

CLF:paf

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