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Planning Your Seed Plant Layout

Bill Gregg

PLANNING YOUR SEED PLANT LAYOUT

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Slimmer profit margins are forcing progressive seedsmen to cut operating costs and increase efficiency at every opportunity. One of the most effective means of increasing both capacity and efficiency is through improved layout of equipment. Effective layout arrangement places all machines in the proper sequence so that the right process is done at the right time, with a minimum of handling cost, and at the most efficient capacity.

Unless you are completely satisfied with the profits from your present operations, it would be to your advantage to carefully study the flow through your seed plant. Are you getting all the capacity you need, or the machines could produce? Is there a bottleneck in either cleaning or handling? Is there an operation that requires constant supervision? Layout improvements may be able to increase your capacity and lower your handling costs.

Before a new plant is built, layout should be carefully planned, so that seed receive the necessary processing in the proper sequence, so that there are no bottlenecks, and operating costs are kept to an absolute minimum. Proper layout planning combined with automated control systems and up-to-date seed handling methods can greatly reduce the processor's costs. For example, Washington State University's old Foundation seed handling system used bags throughout. Labor costs in handling the seed through processing added up to 90 cents per bushel. Pallet boxes and a new seed plant with an up-to-date layout reduced this labor cost to less than 4 cents per bushel.

The keys to efficient plant layout are a thorough knowledge of what you need to do, and sound planning.

First, you must know the general sequence of processes involved between the time the seed enter your processing plant and the time they are cleaned, packaged, and ready for shipment. Diagram 1 illustrates one break-down of these steps. The seed are RECEIVED into the processing plant before any cleaning begins. They may be held in STORAGE until they are cleaned, or sent directly into the cleaning line.

The first phase of processing can be called CONDITIONING AND PRE-CLEANING. This involves removing awns, hulls, etc.; breaking up clusters, scalping off large trash, and other operations which improve the condition and flow-ability of the seed. Such machines as debearders, hullers, and

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[1] Mr. Gregg is Assistant Professor, Department of Agronomy, Washington State University, Pullman, Washington.

scalpers would be used.

The next step is the basic CLEANING. Here the material larger or smaller than the good seed are removed, and they are generally sized and cleaned. The air-screen machine is the basic machine most often found in this operation.

Sometimes seed can be brought up to the required purity in this operation. More often, however, additional SEPARATING AND UPGRADING must be done, using machines which separate seeds that differ in a narrower spectrum of physical properties. Velvet roll mills, gravity separators, magnetic separators, and others are used to remove specific contaminants and increase seed quality.

After purity requirements have been reached, the seed may be TREATED before they are BAGGED or packaged. The seed are then ready for STORAGE or SHIPPING.

The layout planner must have an intimate knowledge of the seed he processes, its physical characteristics, the weed seed and contaminants in it, and the machines needed to bring the seed up to acceptable planting standards. These differ with different crop seeds, so different processing machines are needed. Sometimes seed conditions will require a different sequence of processing.

Diagrams 2-10 show general flow patterns used to process different types of crop seeds. These general flow patterns do not represent any single processing plant; they are composites prepared from the flow plans of many plants. The machines and the sequence used to clean a given crop seed are shown. Under a given processor's conditions, he may not need a particular machine shown here, or may find a different machine is necessary to remove a particular contaminant. Slides accompanying this presentation showed flow patterns and layouts of actual processing plants handling a range of crop seeds.

When the machines and separations needed are selected, the proper processing sequences and capacities must be determined. Sequence is an important factor in processing efficiency. Some machines will make precise separations only after the seeds have been properly precleaned, while others will perform better after the seeds have been through other machines. For example, the gravity separator will separate seeds of the same size but of different specific gravities according to their specific gravity. When the seeds are of similar specific gravities but differ in size, it will separate them according to size. When the seeds are of varying size and specific gravity, a precise separation cannot be made. For precise separations, seeds must be closely sized before they go onto the gravity separator.

The location of the roll mill is another example of efficiency gained by layout planning. Alfalfa seed processors find that gravity separation of seeds

before they reach the roll mill will remove sand, which would cause excessive wear of the roll fabric. The amount of material going onto the roll mill is also reduced, so capacity is increased.

Equipment size or capacity must be carefully planned to prevent bottlenecks. A machine that can handle only 100 bushels an hour, for example, would not fit into a cleaning line with other machines that can operate efficiently at 200 bushels an hour. When the overall operating capacity needed has been decided, all machines must be able to handle that capacity with some operating reserve for problem lots. Surge bins can handle slight variations in individual machine capacities. But, when differences are great, either larger models or more than one machine installed in parallel must be used to maintain uninterrupted flow.

Elevators and conveyors are important equipment in the seed plant. Their selection and installation is as vital to efficiency as any machine. They must be able to handle the capacity needed in a particular spot, and they must be carefully adapted to the seeds handled. For example, elevators handling chaffy grass seeds must move the seeds without bridging or plugging. Elevators moving beans and peas must not cause mechanical injury.

When the type and size of elevating equipment are selected, the actual plant layout planning can begin. There are two main methods of layout.

The multi-story plant has been a long-time favorite. In this system, seeds are carried by elevators to the top floor and emptied into large bins. Cleaning machines are then arranged in vertical series on lower floors. Seeds flow from one machine down into the next by gravity.

Multi-story processing plants clean a wide range of seeds in many seed-producing areas. Minimum expense for elevating equipment is their big advantage, since seed flow is largely by gravity.

Many plants are being built today with all cleaning machines mounted on a single level, or on platforms on the same floor. In the single-story plant, seeds are moved from one machine to the next by elevators placed between the machines. More outlay for elevating equipment is needed, since a separate elevator must feed each machine. But, supporters of this design are quick to point out that building costs are much less, and smaller, less expensive elevators are used. A great advantage of the single-level system is that one man can supervise the processing line without running up and down stairs. He can maintain a closer supervision of each operation, and produce cleaner seed at a higher capacity.

Many seedsmen find that a compromise between the single and the multiple-story system fit their needs best. New automated and remote control systems fit either system, and result in large gains in efficiency.

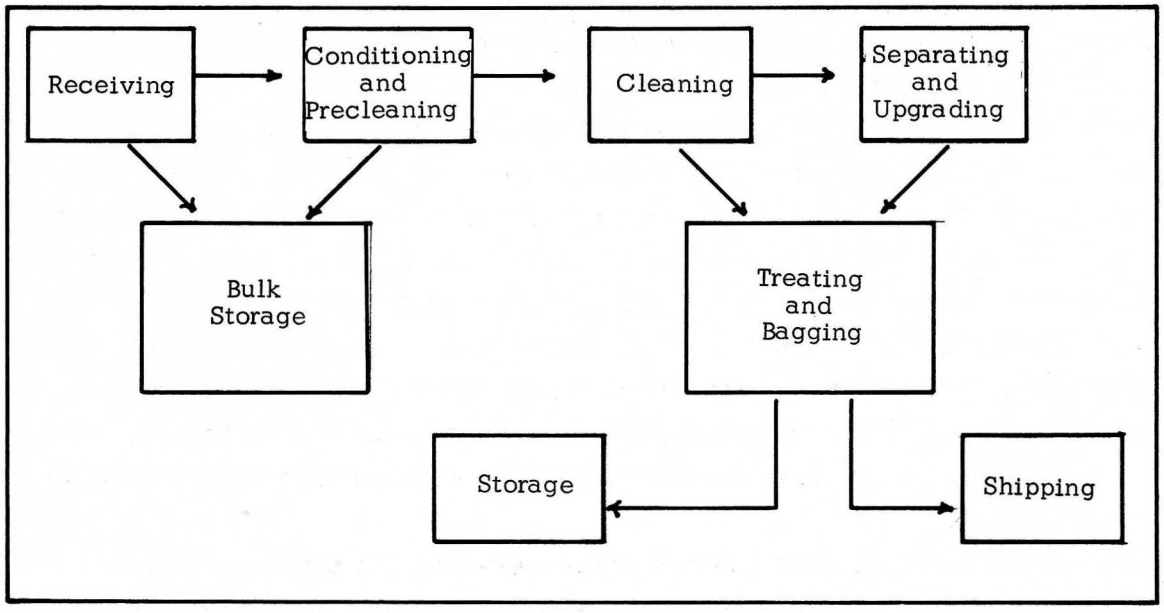
After the proper machines, elevators, capacities, cleaning sequences,

and layout system have been selected, layout planning can begin in earnest. Careful layout planning will show up possible bottlenecks and trouble spots before the plant is built, and will prevent many headaches and lost hours.

Put the proposed layout on paper, and study it thoroughly. A good method is to draw lines of flow, and then convert flow lines to machine lines. After these have been revised, scaled drawings can be made to show exact locations and distances. Scale drawings are the most widely used method of layout planning. Scale models and scale templets are also very effective, but are more expensive.

Layout planning is today a science in itself, and is a valuable tool of process industries from seed processing to automobile manufacturing. Improvements are frequently reported in journals serving the process industries. Equipment representatives are usually trained in plant layout, and the seedsman planning a new plant should take full advantage of their special knowledge.

Diagram 1. Basic Flow Diagram Showing Essential Seed Processing Steps



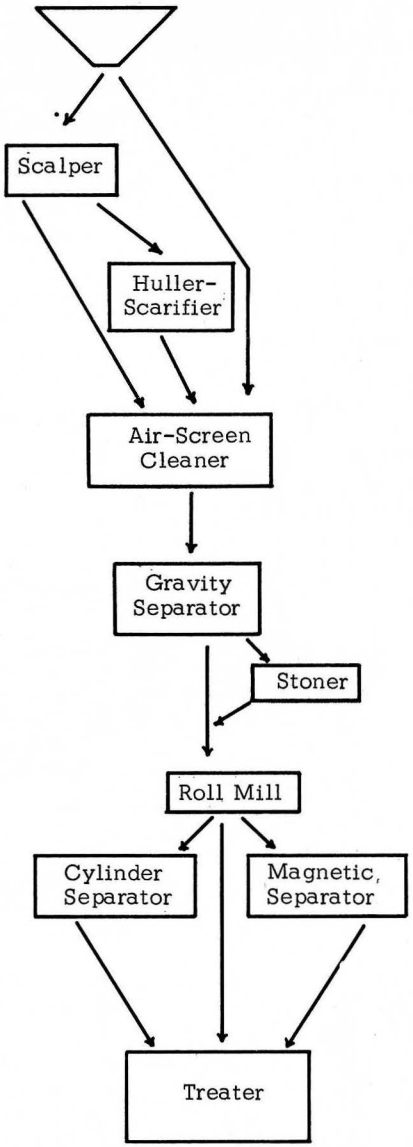


Diagram 2. Alfalfa & Clover Seed Flow Diagram

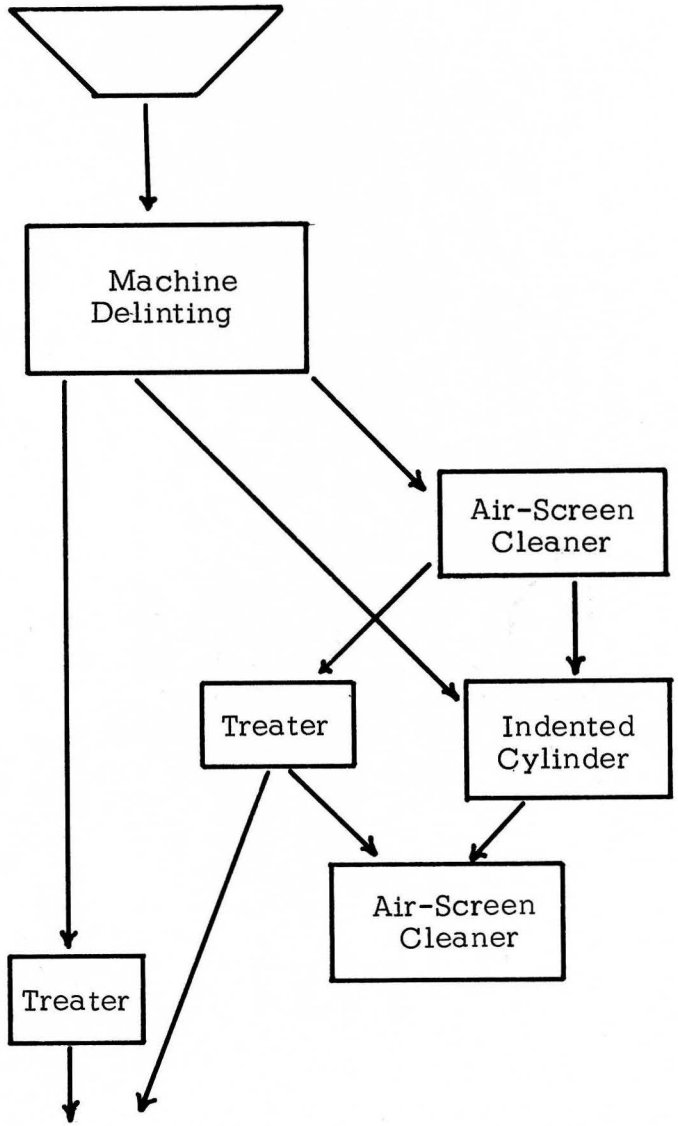
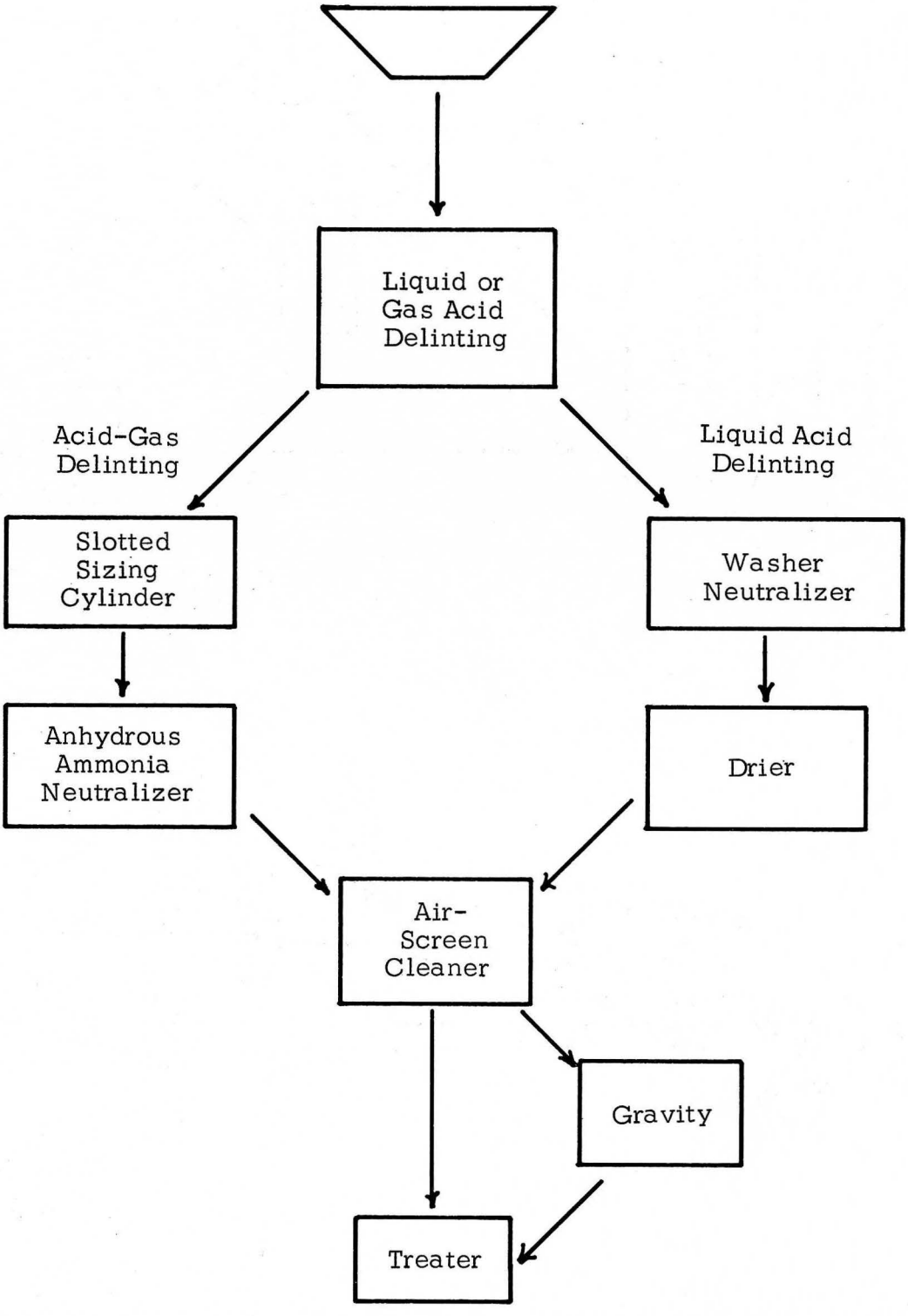


Diagram 3. Cotton Seed (Machine Delinted) Flow Diagram

Diagram 4. Cotton Seed (Acid Delinted) Flow Diagram



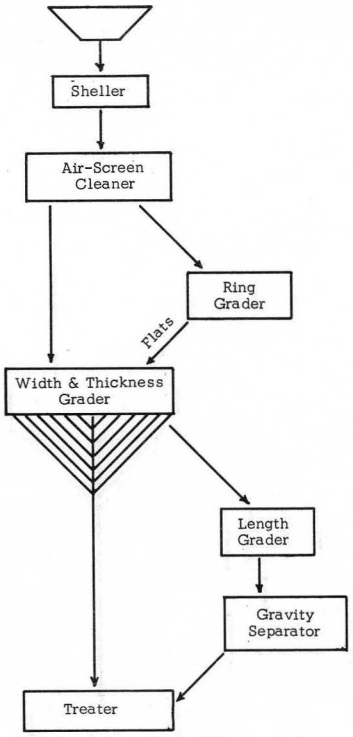


Diagram 5. Hybrid Corn Seed Flow Diagram

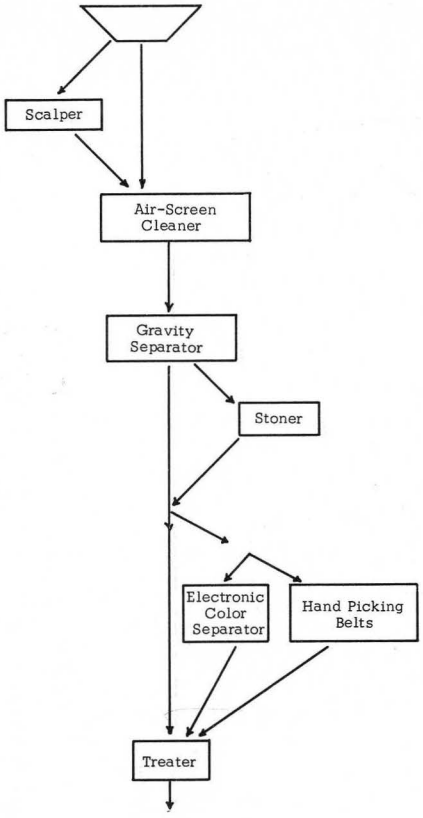


Diagram 6. Pea & Bean Seed Flow Diagram

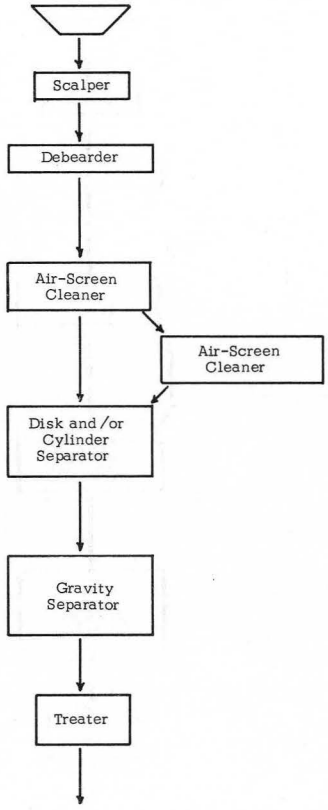


Diagram 7. Grass Seed Flow Diagram

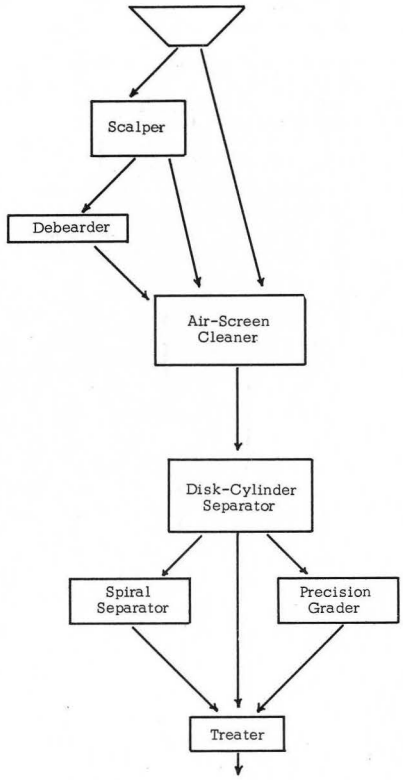


Diagram 8. Small Grain Seed Flow Diagram

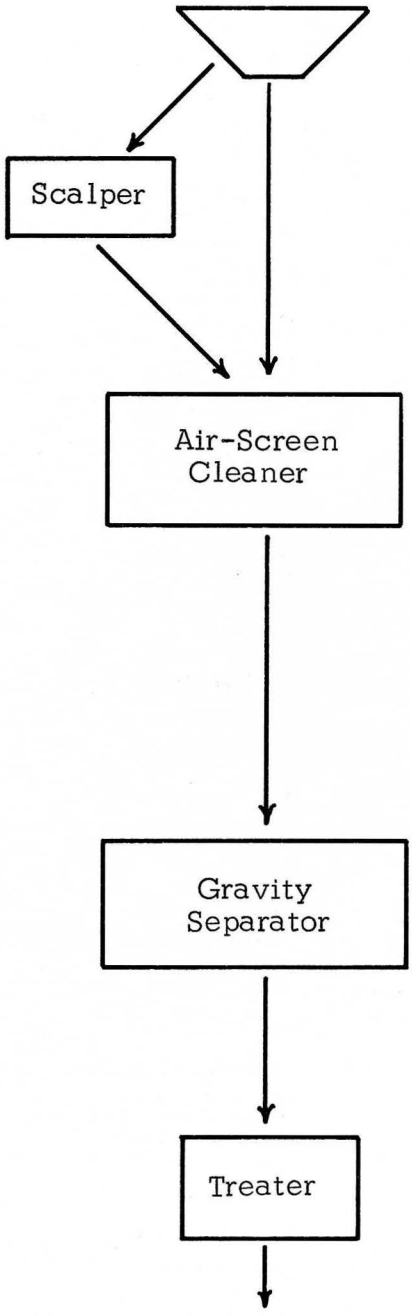


Diagram 9. Sorghum Seed Flow Diagram

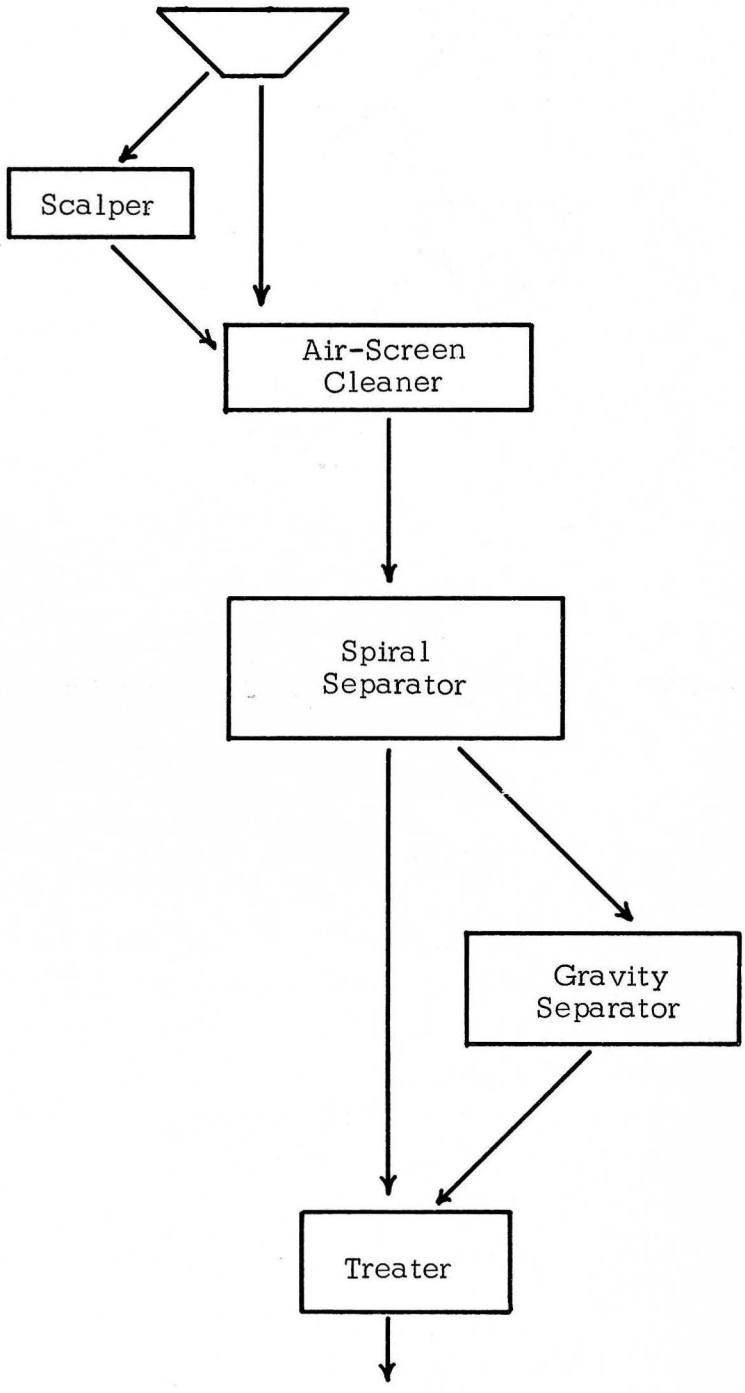


Diagram 10. Soybean Seed Flow Diagram