# NEW DEVELOPMENT IN SPRINKLER SYSTEMS AND INJECTING CHEMICALS THROUGH SPRINKLERS

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As you can tell from the title, I will really be covering two subjects. I intend to spend the majority of my allotted 20 minutes discussing and showing slides of two new approaches to automated irrigation through the use of sprinklers. I will then briefly describe and show slides of equipment currently being used to inject chemicals into sprinklers.

In recent years in California, there has been considerable activity in the installation of sprinklers in tree crops and grapes. These installations have generally been impact-type sprinklers mounted on PVC risers of varying heights and fed from underground PVC laterals. There has also been considerable use of hose pull sprinklers, where cost considerations made permanent installations prohibitive. According to a recent University of California study on irrigation costs, permanent set sprinklers cost about $1335/acre with total annual costs of $220/acre. Capital cost of hose drag systems are about $595/acre with annual costs of about $204/acre.

The traditional means of irrigating field and vegetable crops with sprinklers has been with "hand move" sprinklers, generally using aluminum laterals with impact sprinklers In recent years, wheel line sprinklers have gained in usage. Investment cost for "hand move" sprinklers is about $460/acre with annual cost of about $165 per acre. For wheel lines, the capital cost is about $520/acre with annual costs of about $141 per acre.

Sprinklers have traditionally been used where the cost of leveling is prohibitive; or hardpan makes it horticulturally unfeasible to furrow irrigate; or the water table is very high; or water is scarce and/or expensive. (There are other reasons but these are the main ones.) The major problems with sprinklers have been that solid set installations where labor is eliminated are very expensive (capital cost of $1335/acre) and that labor costs ($72/acre/year) and labor availability/reliability are a major consideration with less expensive "hand move" or "wheel move" systems.

A solution to these problems where sprinklers are required is center pivot sprinklers where capital costs run around $600/acre and where annual operating costs run about $134 per acre. Center pivot has all the water saving advantages of other sprinklers, but since they are fully automated, labor costs are materially reduced ($72/acre/year for "hand move" vs. $4.50/acre/year with pivots).

Pivot irrigation was developed over 25 years ago and has been highly successful in the mid-west and Pacific north-west. Currently there are about 6 million acres irrigated by center pivots in the United States. The original systems were water driven units with steel wheels. They were tried in California in the mid 60's, but the combination of steel wheels and high clay content soils made these types unsuccessful under most California conditions. Furthermore, with our expensive California land, most farmers could not afford to only irrigate 130 out of 160 acres.

Now center pivot irrigation has come to California. The change to electric or hydraulic drive, plus the development of the technology to irrigate the corners, along the more recent development of the low pressure, spray nozzle units and the use of booms to keep the wheels operating on dry ground, in addition to high flotation tires, are the principal factors contributing to increasing acceptance by farmers.

Of these factors, the development of the corner system by Valmont Industries of Valley, Nebraska, some 5 years ago is the principal factor. The Valley corner system will irrigate 152 acres of a square quarter section. It will also irrigate odd shaped and irregularly shaped fields. Total capital costs run about $730 per acre according to the University of California study but annual costs run only about $126/acre. Of all 10 methods or irrigation studied in the recent University of California study, center pivot with the corner device is the least expensive except for flood irrigation. The big savings are in labor costs which the University of California study shows to be $67.50/acre/year. That savings alone will pay for the annual cost of owning the equipment. We had 300 acres of

canning tomatoes in the Stockton area when the labor cost was only 50¢/acre. These automated sprinklers are really a classic example of labor capital substitution.

I wi now show you slides of the Valley corner system. (Slides are shown

One of the very interesting things we have learned over the last two years is that sprinklers can be used for irrigation tomatoes completely through to harvest. The only principal field or vegetable crops that we cannot irrigate through to harvest are rice, melons and lettuce, and currently research is indicating rice can be sprinkler irrigated.

A very recent development by Valmont, Industries is the new Rainger linear sprinkler It uses the same basic hardware as a conventional pivot, but instead of operating in a circle or square circle, it moves in a straight line down a rectangular field. It pumps water out of either a concrete or dirt ditch as it moves along. It is powered by a Deutz diesel that not only powers the pump, but also generates electricity to operate the 1 H.P. electric motors that drive each tower. It operates on high flotation rubber tires.

This system has been in development in the past 2 years with prototypes operating under varying soil and crop conditions. It was formally introduced by Valmont on Nov. 22nd at the system Tenneco has installed on table grapes in the Bakersfield area. It has also irrigated tomatoes, field corn and sugar beets.

The linear is particularly suited for rectangular-shaped fields--particularly long, narrow 1000-2000 ft. wide fields, (which we have plenty of in California). Also, since it distributes water equally along the full length of the system, it can apply water on low infiltration rate soils where a conventional center pivot may have problems. It has the advantage of being a completely independent unit with no need for any additional installation except for a ditch.

I'll now show a few slides of the new Valley linear in operation. (Show slides).

My final remarks will be on injecting chemicals through these automated sprinkler systems. Part of the cost savings possible through automated sprinklers is that by injecting fertilizers, fungicides and herbicides through the equipment, a material reduction in tractor and/or airplane application costs can be realized. This can amount to a $20-25 per acre savings alone which is about 40% of the annual cost of owning an automated sprinkler. Keep in mind that these sprinklers have about a 90% coefficient of uniformity--better than many spray rigs.

With the center pivot, an Injecto-meter type piston pump is used to inject the material directly into the system. By adjusting the stroke on the pump pistons, the precise amount of material is metered into the sprinkler. Some installations have the mixing tank permanently located at the injection point, while in other cases the mixing/injection equipment is mounted on a trailer so that it can be moved to different pivots. In most cases, fertilizers are injected directly out of the fertilizer company's nurse tank. Herbicides and fungicides are usually mixed and injected out of smaller, farmer-owned tanks.

I will now show you pictures of the basic equipment that we've been using to inject chemicals.

With the linear move equipment, it is proposed that the injection pump be mounted on the sprinkler using the Deutz powered generator for power. The materials holding tank would be towed directly behind the base tower. I must comment that we have not yet actually injected material through a linear, but there is no reason that it can't be done.

I believe the center pivot with the ability to irrigate the corners and the automated linear concepts are the irrigation future for a significant portion of California's irrigated grape and field crop acreage. The increasing cost and reduction in dependability of labor for not only moving sprinkler pipes or changing siphons makes the move to automated irrigation the next big revolution for California agriculture. Furthermore, conservation of water and water efficiency will be a way of life for irrigated agriculture in the future. For most field and vegetable crops, automated sprinklers make the most sense when cost and water conservation factors are combined.