

## EXPERIENCES WITH LINEAR-MOVE SPRINKLER IRRIGATION OF ALFALFA ON NEWLY DEVELOPED SOILS

Jim Farley and Les Travis<sup>1</sup>

When the first linear-move sprinkler irrigation system was put into use in 1978 on Newhall Land and Farming's Merced Ranch, a great deal of thought and economic analysis had been given to irrigation alternatives.

Four methods of irrigation had been used prior to 1978; flood irrigation, solid-set sprinklers, hand-move sprinklers and wheel-move sprinkler lines. A large block of native grassland was to be developed for crop land and rising electrical power rates was the impetus to cause Newhall management to look for alternate irrigation methods and systems. The irrigation water for the Merced Ranch comes entirely from wells on the ranch. The average pumping depth is 210 feet and water costs in 1982 are \$35.00 per acre foot.

Center pivot irrigation systems were considered and many installations were visited. Newhall management felt that the center pivot systems were not adaptable to their ranch. However, a variation of the center pivot, linear-move sprinkler systems showed promise.

After the decision was made to install a linear-move sprinkler system, a 320-acre block of native grassland was selected for the first field to be developed utilizing the new system. The field was leveled to remove the mounds and fill the low spots in the field. The field was ripped, gypsum applied, and the field was finish-planed prior to planting alfalfa in the fall of 1978. Many farmers in the El Nido area watched that field which has been termed the "great experiment." The alfalfa germinated, grew, and five cuttings totaling 4.29 tons of alfalfa hay were harvested during the 1979 season.

There were some lessons learned from that first field. First of all, without careful management, the linear-move could bog down in the alkali spots which remained in the field. Ripping of the soil resulted in spots where the wheels of the system might begin to sink and the system would become stuck. Water application strategies were also fine-tuned in order to reduce water consumption, yet apply adequate amounts of water in order to obtain maximum yield.

The lessons of 1978 and 1979 have led to the management plan currently used in 1982, to operate the 15 linear-move systems now in operation. Nine linear-move systems have been added since the fall of 1981. In each field where a linear-move system is to be installed, the areas where the wheels track are carefully marked and staked. When the field is ripped, the ripper travels only in the direction the linear-move system will move. There is no cross ripping and the ripper stays 2½ feet away from the marked sprinkler wheel track. This has eliminated many of the problems of the system causing deep ruts in the field or becoming stuck in loose ground.

Today when alfalfa is to be planted under a linear-move system the field is ripped to a depth of 48 inches, finish-planed two times; the field is seeded by airplane, then sprinkled with the linear-move system to germinate the seed and establish the stand. Once the alfalfa is established and is being cut for hay, an irrigation management plan developed from experience is followed. As soon as the bales are picked up, the linear-move system is started and is set to move across the field at 90% movement. This means that the system will be moving 90% of the time or 54 seconds each minute. This setting will apply .26 inch of water during that application. Once the system has covered the field, it is reversed and set for 20% movement or 12 seconds of movement each minute. This movement rate applies 1.25 inches of water. A total of 10 inches of water is applied between cuttings, each application is 1.25 inches, except for the .26 inch application just following harvest and a .26 inch application which just precedes cutting. The final irrigation is applied to give just enough moisture to carry the plants through the week of harvest operations before moisture depleted during that period can be replaced.

Farm Advisor, University of California Cooperative Extension, Merced, and  
Manager, Newhall Land and Farming, Merced Ranch, El Nido, California, respectively.

The linear-move systems have been used to apply herbicides and plant nutrients. However, no acidic materials are applied through the system. In the case of herbicides, the container is attached to the power cart where the engine, pump and generator are located and the material is metered into the ditch right at the suction line. Fertilizers are metered into the center ditch which provides water to the linear-move system.

The management at Newhall Land and Farming has found that irrigation labor expenses have been reduced by \$25.00 per acre since the installation of the linear-move systems. However, it is important to outline the labor requirements necessary to operate the 15 machines that they currently have on the ranch. During the day one man on a three-wheel motorbike is responsible for operating five linear-move systems. His responsibility is to start and stop the machines, change movement speeds of the machines, if necessary, and clean plugged sprinkler heads and suction screens. At night, one man is on duty to see that all 15 machines are operating. Should a machine shut off, he will attempt to restart it. If he cannot restart it, he then turns off pumps to compensate for reduced water requirements. The machine will be started again during the day when maintenance is easier by daylight.

In addition to the three day men and the one night man, there is also one man in a pickup that carries out general maintenance and service on all machines during the day. His responsibility is to check tire pressure, engine oil level and lubricate the machines when necessary. Since the diesel engines are air cooled, it is also his duty to keep the cooling fins clean. On a typical day he will visit each linear-move system two times. The machines are refueled by the ranch service truck when the system is at the end of the field and easily accessible by road.

One last comment about system maintenance. During the off-irrigation season each machine is started weekly and moved at least 100 feet. This is done to prevent damage to the engines during long periods of non-operation and to prevent tires from developing flat spots due to prolonged periods without movement.

Advantages of linear-move systems to produce alfalfa hay:

1. The management at Newhall Land and Farming believes that they can successfully develop new cropland using linear-move systems. Reclamation of the soils is possible due primarily to the control of water application rates possible with linear-move systems.
2. Water usage has been reduced using linear-move systems. At least one acre-foot of water per year is saved using the linear-move sprinklers. This results in a saving of \$35.00 per acre.
3. A labor savings of at least \$25.00 per acre has been realized with the use of linear-move systems.
4. Reduced costs to establish alfalfa. The costs associated with border making, ditch building and pre-plant herbicide application are eliminated. Also, costs associated with field preparation for pre-irrigation are also eliminated.
5. Hay quality is improved. Although the management is not certain why hay quality has been improved, there has been increased hay quality where alfalfa has been grown under linear-move systems.
6. Alfalfa stands may persist longer. At this time it is not known for certain if stand life will be longer. However, the appearance of the fields seems to indicate that alfalfa stands will be productive at least one year longer.

Disadvantages of using linear-move systems:

The primary disadvantage of the systems are some periods of down time. These periods result from plugged suction screens, electrical micro switches, and other mechanical parts that fail. These periods of down time have not created a problem for Newhall because the management planned a 20% safety margin into their systems. Each linear-move line has at least 20% of the total acreage allotted to winter crops. Therefore, instead of the system running at maximum, it must irrigate only 80% of the acreage, which allows for time to make up for time lost due to down time. Newhall Land and Farming management is convinced that linear-move sprinkler irrigation systems have a place in alfalfa production and feel that they can be utilized effectively to produce alfalfa on newly developed soils.