# *Farm Dairy Effluent Irrigation Evaluations*

# *Pivot 3*

## System details

- Pivot fitted with gun - hydrants at middle towers
    - Pivot wipes, 345 deg rotation
    - Used to apply all effluent generated from the shed
    - Gun moved from tower 4 to tower 8 (of 9 towers plus corner and extension)
    - Irrigator always runs at 100% speed so applied effluent depth varies on each tower
    - Gun does 180 deg arc behind (or in front of) pivot while water is running
    - Spread 60m some overlap between sets,

- Soils are
    - Soil type, loam
    - Significant ponding and mud on day of visit.

- Effluent consents held
    - discharge contaminants on to land in circumstances in which they may enter water
    - Conditions
        - 5,400 L/d averaged over 7 days ( cows)
        - discharge area defined on map
        - not greater than 200 kgN/ha
        - not exceed half the water holding capacity of the soil
        - no ponding of effluent on ground
        - effluent may be stored . . .

Figure 1. Gun with stuck Drive Arm

Figure 2. Gun operating correctly

# Initial effluent irrigation evaluation

**Pivot with tower mounted gun:**
This irrigator is fitted with a gun mounted on towers. There are problems with the gun blocking. Post evaluation visit information suggests that two guns can be run at once with the existing pump, though pipeline sizes may be restricting.

A summary of system performance is given in Table 1.

Table 1: Summary of Effluent Irrigation Performance Pivot on 100% Speed

| Pivot with Rubber Nozzle Splash Plates | Tower 4 | Whole Field | |
|---|---|---|---|
| Application Area | 7.8 | 57.0* | ha |
| Effluent Mean Depth | 5.48 | 4.30 | mm |
| Hi Quartile Mean Depth | 10.23 | 7.43 | mm |
| Low Quartile Mean | 0.85 | 1.77 | mm |
| DU high | 1.87 | 1.73 | |
| DU low | 0.15 | 0.41 | |
| Mean Application Rate | 12.4 | 9.7 | mm/h |
| Max Application Rate | 23.1 | 16.8 | mm/h |

* assumes full circle rotation.

# Effluent Applied Depth

The mean depth applied was about 5mm per application. The depth applied is very variable, both within effluent application sets and along the length of the pivot.

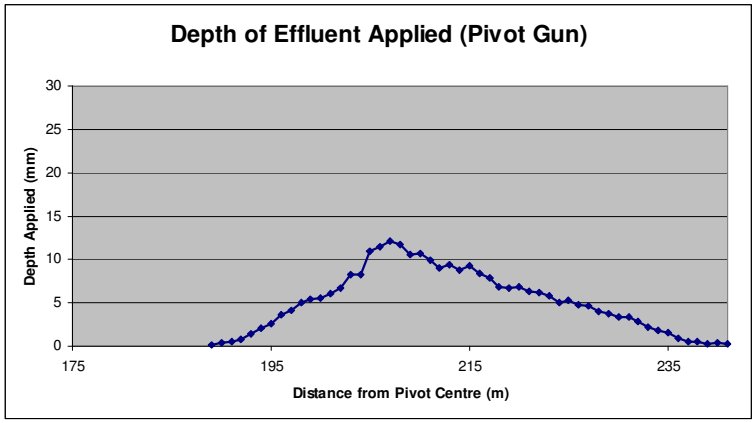


Figure 3. Effluent application pattern as measured at Tower 4

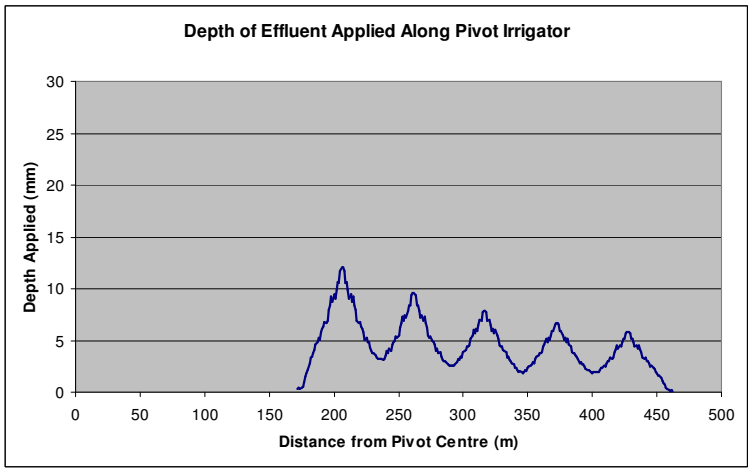


Figure 4. Derived application pattern for five tower positions

The graph (Figure 4) is as the machine would operate as the gun is moved from tower to tower. The graph assumes each section will be operated at the same pivot speed and for the same number of passes. It also assumes the pressure at each tower is the same, which is unlikely. The application pattern shown is an overlapping of the apparent individual nozzle performance based on measurements made in the field, but adjusted for a full 180$^{o}$ gun sector pattern.

## Effluent Application Area

The effective area over which effluent is applied is a calculated value. It is determined from areas calculated by subtracting inner from outer extents of rings of application as determined from derived application patterns (shown in Figure 4).

Table 2: Area of Effective Effuent Coverage

| | Radius (m) | | Area (ha) | |
|---|---|---|---|---|
| Tower# | Inner | Outer | 360$^{o}$ | 345$^{o}$ |
| 4 | 172 | 233 | 7.76 | 7.44 |
| 5 | 234 | 289 | 9.04 | 8.66 |
| 6 | 290 | 344 | 10.76 | 10.31 |
| 7 | 345 | 400 | 12.87 | 12.34 |
| 8 | 401 | 462 | 16.54 | 15.85 |
| TOTAL | | | 56.96 | 54.59 |

## Recommended improvements

At the time of arrival for testing the gun was not working correctly – effluent had stopped the Drive Arm from moving, so the gun was stationary. This was easily fixed – simply by moving the Drive Arm up and down to restart it.

When the gun was operating, it was only covering about 135$^{o}$ arc rather than a full 180$^{o}$. This significantly affected the distribution pattern.

- Both these problems are simple management issues, but indicate potential problems that require ongoing monitoring to avoid.

We were not able to monitor gun operating pressure on the day of testing. It would be desirable to assess operating pressures at all towers and compare with the design pressures for the gun. If pressure is significantly lower at outer towers, both the gun wetting radius and the flow rate will be reduced. Both issues will affect nutrient application amounts and uniformities.

- Check gun operating pressures (and wetting diameter/overlap) at all towers.

Note however that there are varying depths applied as the machine travel speed is higher further from the pivot centre. This effectively compromises efficiency, reducing uniformity across the field as a whole.

- Management can address this by operating the end effluent nozzles more frequently than those closer in to the centre.