

DPI&F note

Sub-surface drip irrigation:

Installation

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It is critical that sub-surface drip irrigation (SDI) systems are installed correctly. This will ensure the system performs optimally and in part determines the expected life of the system. The oldest SDI system in lucerne in Australia was installed in June 1994 and is still performing well through good installation and management by the irrigator. There are other examples where systems have failed within months of installation usually as a result of poor design, poor installation and/or poor maintenance.

Planning

It is essential to plan the installation of a SDI system in detail. You should follow the installation design provided and the instructions of the manufacturer. The first step is the selection of the site. SDI should not be installed into blocks that have not been cropped recently – insect activity in pasture or weedy areas could seriously damage the installed laterals within days of installation. Similarly, installing SDI into “new” country will result in uneven installation as it will be difficult to install the laterals at an even depth and you run the risk of tape damage during installation or in subsequent tillage operations.

Other points to consider are:

- The pump must be sufficient capacity at all times to prevent a vacuum forming, even during flushing of laterals and the flushing manifold
- Use short sub-mains and do not connect laterals to lines with a diameter of 200mm or greater
- Insert vacuum breakers at the end of each sub-main and flushing manifold, at intervals of at least every 50 laterals
- Do not drop below a 90% distribution uniformity (DU – also referred to as the emission uniformity or EU) or a 10% flow variation when planning the system and deciding on the length of laterals. This value is calculated by dividing the minimum emitter flow rate or average of the lowest 25% of emitters by the average of all the emitters.

Preparation

Installation should be done well before planting the first crop. The field should be cross-ripped to the depth of tape installation to ensure even depth of placement. It should be cultivated to reduce clod size and provide a firm level surface. For lucerne it is recommended that an annual crop be grown following installation and before planting the lucerne. This will enable the field surface to be levelled before planting lucerne – an important consideration otherwise the field will be too rough on haymaking equipment when travelling around the field. Mark out the area to be installed accurately.

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Laterals

For your first SDI installation you should work with an experienced SDI installer or alternatively assist an experienced SDI irrigator install one of their blocks to gain the necessary experience in doing your own installations.

Mark out the location of the laterals using a subsoiler or ripper with tines at the desired spacing and depth. GPS equipment now makes accurate location of the drip tape possible and benefits subsequent crop planting particularly where wide lateral spacings are used in row crops.

Specialised injectors are available for the installation of SDI laterals. An example configuration is provided in Figure 1. It is essential that the tape be laid accurately at the desired depth – this is assisted by the use of depth wheels on the injection feeder. Periodically check the depth of installed tape during installation by digging down and measuring the depth with a tape measure. Drip tape is supplied on reel mounts that must be able to move freely so the lateral enters the injection tube freely. Stretching or pulling of the lateral can scratch or cut the lateral leading to soil entry and causing start-up clogging.

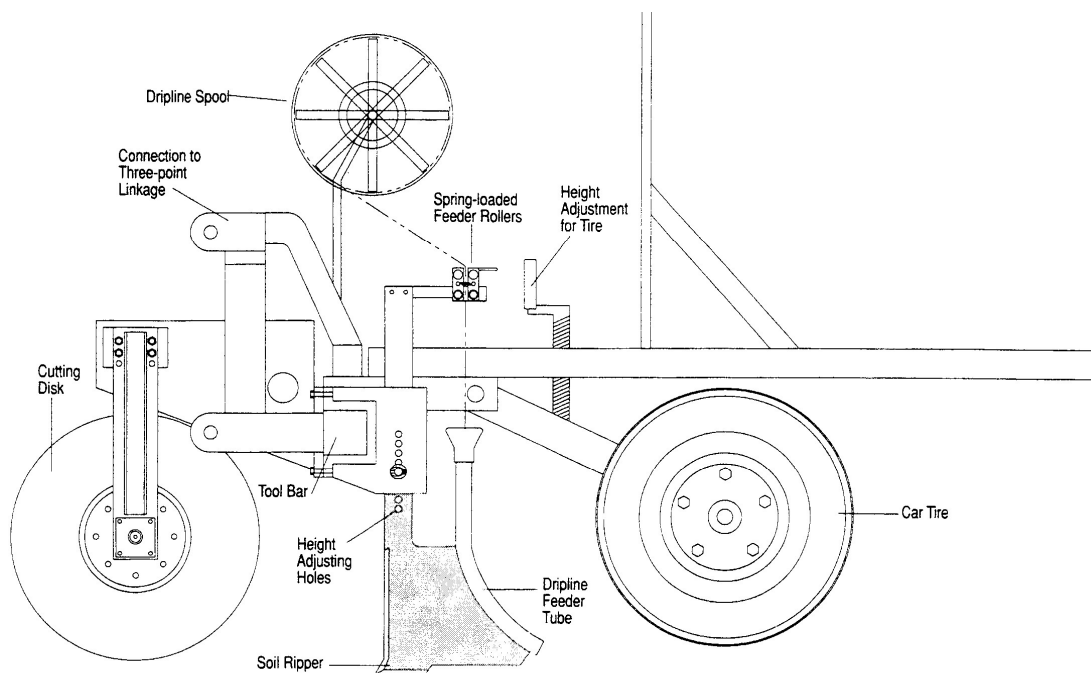


Figure 1: SDI lateral injector (Source: Netafim Australia)

The reel mount should have a braking mechanism to avoid over-running the end of a row. It is also essential that the drip tape does not twist during installation – the tape must always be installed emitter side facing up to assist in preventing emitter clogging. There have been some installations where the tape has been installed with the emitters facing downwards with serious clogging resulting.

The lateral should not be dragged over sharp corners or rough surfaces as it is fed into the injection tube. When the stopping and starting the tractor be careful not to roll forwards or backwards as this will cause the lateral to tear or kink, stopping the water flow. Adjust the speed of injection to the condition of the field.

Beware of the entry and exit elevations to the block. If this is not at the same elevation as the field (for example if driving through a table drain onto a roadway) then the tape depth could be shallower than desired increasing the risk of damage with subsequent cultivation. It is labour intensive and time consuming to rectify this problem.

Sub-mains and flushing manifold

After installing the laterals use a trencher to dig in locations where the sub-mains and flushing manifold are to be installed. The trench must be at least 100 to 150 mm wider than the pipes for easier installation. The loose soil must not be allowed to fall back into the trench before installing the pipes. Otherwise the pipes will settle following installation resulting in disconnection of the riser tubes that attach the laterals to the sub-mains and flushing manifold.

The sub-mains and flushing manifold should be laid deeper than the laterals to allow for tape retrieval without disturbing the sub-mains. Lay out the pipes on the field surface and connect them. Make sure the trench is flat and free of loose soil and rocks to avoid damaging pressure on the PVC pipes.

With 50 to 75mm sub-mains it is best to drill holes for the risers (blind tubes) into the PVC pipes on the field surface before placing them in the trench. For these pipes there is generally not sufficient space to drill them in the trench. Where the trench is greater than 100mm it is possible to work in the trench and drilling of the pipes should be done with them placed in the bottom of the trench – this ensures that the drilled holes line up more accurately with the appropriate laterals. The drilled hole must be clean of burrs, precisely rounded and the recommended size for the start connectors that will be fitted to the riser tubes. Always use a sharp drill and check it throughout installation for adjustment, cleaning and sharpening.

The hole position need not be on the top of the pipe – it should be drilled to create the best angle between the lateral and the riser. Where a centre-feed sub-main is used it is best to drill holes either side of the centre line of the pipe – drilling holes close together on the centre of the pipe will weaken the PVC.

Install the riser tubes as per the manufacturers recommendations – make sure that there are no sharp angles created in the riser tube which could result in kinking and blocking of water flow.

System start-up

You should install each SDI block in the field in a single day and apply water through the system as quickly as possible. This will reduce the risk of insect damage. Serious damage has been observed where delays of several days have occurred between installation and the first water being applied. Water around the drip tapes tends to discourage insect activity.

The steps to follow in the initial start-up are:

1. Check, clean and backflush the filter. This is desirable even with media filters where new sand or gravel has been used. Dust from this new media can block emitters if backflushing is not done.
2. With automatic backflushing systems make sure there is sufficient pressure and the flushing duration is adequate. The initial backflushing should be done manually.
3. Check the pressure reducing valves are adjusted to suit the recommended working pressure for your laterals as per your system design tables. Fill the system gradually, one sub-main at a time. Connect the laterals to the sub-main via the riser tubes using the manufacturers recommended joiners, leaving the flushing manifold valve open. Always photograph all major valve assemblies and pipe junctions before backfilling. This will help if repairs are needed in the future.
4. Evenly distribute soil around the sub-main and risers in the trench. Cover the pipes with fined loose soil up to the height of the PVC pipe. Ensure the air vacuum outlets are in place and the flushing taps are open. Water should then be gradually let into the system to flush out any soil or PVC shavings that may be in the system. Fix any leaks that are found. Following this fill in the trench carefully while the system is operating (to prevent pipes from collapsing) – make sure risers and laterals are not kinked while doing this.
5. Then connect to the flushing manifold. Make sure the flushing taps are open for the initial flushing of this part of the system.
6. Once the system is in full operation check all pressures and flow rates, particularly at the farthest points of the system. Make sure operating specifications are met.
7. Walk through the field checking for damage, leaks or blockages (downstream of a blockage the lateral will be limp). Repair as needed.
8. Set up the controller, fertigation equipment, etc and test their operation.

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Further information

Burt, C.M. and Styles, S.W. (1999) Drip and Micro Irrigation for Trees, Vines, and Row Crops: Design and Management, California Polytechnic State University, San Luis Obispo, California

Dasberg, S. and Or, D. (1999) Drip Irrigation. Springer, New York.

Harris, G.A. (2005) Sub-surface drip irrigation – Advantages and Limitations, DPI&F Note, Brisbane

Harris, G.A. (2005) Sub-surface drip irrigation – System components, DPI&F Note, Brisbane

Harris, G.A. (2005) Sub-surface drip irrigation – System designs, DPI&F Note, Brisbane

Harris, G.A. (2005) Sub-surface drip irrigation – System maintenance, DPI&F Note, Brisbane

Harris, G.A. (2005) Sub-surface drip irrigation – Crop management, DPI&F Note, Brisbane

Hassan, F.A. (1998) Microirrigation management and maintenance. Agro Industrial Management, Fresno, California

There are an increasing number of commercial irrigators experienced with SDI within Australia across a range of crops. If considering SDI you should discuss this with experienced growers as well as the experienced field staff of the major SDI system suppliers who can put you in contact with experienced SDI irrigators.

Information is also available on the World Wide Web through the Trickle-L Discussion List. This list has over 650 members (irrigators, manufacturers, resellers, researchers, extension personnel) in 35 countries. Details on joining this list can be found at the Microirrigation Forum Web site at www.microirrigationforum.com. This site contains archives of discussions related to drip irrigation (and SDI in particular) that you can readily examine.

Further information (continued)

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