Proceedings of the International Conference for Agricultural Machinery & Process Engineering
October 19-22, 1993, Seoul, Korea

Drills For New Irrigation Methods In Xinjiang

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ABSTRACT

Xinjiang locats on the Middle Eurasia. Droaght features Xinjiang's climate, especially during the spring sowing season. Therefore, efficient irrigation system is indispensable to Xinjiang farming. Furrow orborder irrigation system has replaced flooding irrigation. In farmland, new irrigation methods have been developed and introduced to more fields. This artical introduces two sowing machines for new irrigation methods: (1) Furrow or border grain drill; (2) On-film irrigation drill.

Key word: Irrigation, Forrow, Border, Drill.

INTRDUCTION

Xinjiang locates on the Middle Eurasia and belongs to a typical drought area in China with scarce precipitation. Arid and high evaporation make it neceseary to irrigate fields for grass growing, tree planting and farming. After many year's endeavor in developing the resources of ground water as well as surface water, certain water storage capacity has been established. Surface irrigation net from reservoirs to fields has been developed so that fields in Xinjiang can be irrigated.

With the development of agriculture, great contradiction have been caused between water supply and water application. In spring, wheat area to be watered is so great that water application in this season covers almost 45% of that in a year while the water supply reaches only 17%.

Serious water shortage retards the development of agriculture greatly.

Extensive work has been done in improving surface irrigation techniques. Flooding irrigation has been replaced first by border check irrigation (fig. 1) or small border irrigation, then by furrow irrigation (fig. 2). All these efficient water-saving irrigation methods have brought satified results for farming along the Tian Shan Mountain in North Xinjiang. Appropriate drills have been designed and manufacted to fit border and furrow irrigation.

In the early 80s', film covering technique was introduced into planting row crops in order to increase soil temperature and maitain soil water (Sui Hong-jian 1990). It also improves the plant's mature difficulty caused by short frost-free period in Xinjiang especially. On conclusing, yields have been increased obviously by using film covering technique in Xinjiang.

On-film irrigation is an efficient water saving method that requires less investment so that it has been estended gradually. At first, film was covered on seed bed, and water run through the furrow (fig. 3). Now, seed bed covered with film is made a furrow shape. Water runs on the film and permeats into soil from the holes out which crops grow (fig. 4).

As a result, the problems of uneven distribution in border flooding and low efficience in border flooding and low efficience in furrow irrigation can be improved (Si Tu song, 1990). By redesigning the exist film-covering drills, we can realize the on-film oozing irrigation which applys to fruit and vegetable cultivation in addition to row crops such as cotton and grains.

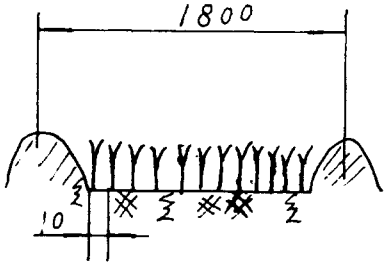

Fig. 1. Border irrigation

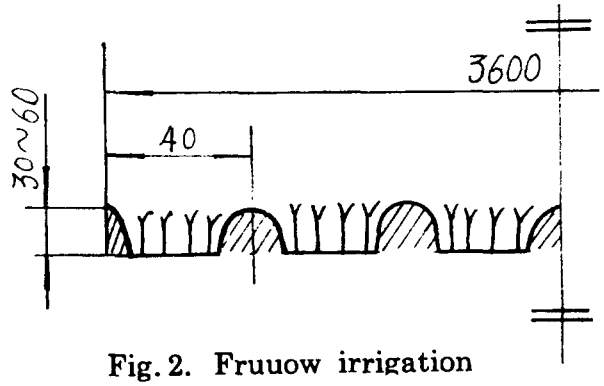

Fig. 2. Fruuow irrigation

FURROW GRAIN DRILLS

Previous grain drills in Xinjiang have to be furnished ridge-former (fig. 5) which can form big border up to 1.8m wide and small border 0.8～0.9m wide (fig. 1.2.). In North Xingjiang along the Tianshan Mountain, strong winds and snows make it prior to adopt furrow planting to border planter. Furrow planter (fig. 6) is made of draw frame 1、share opener 2、planter opener 3、press wheel 4、road wheel 5 and seed、fertiliz erbox 6. The share opener is built on the front cross arm of the seed box. Furrow dept vary from 30cm to 60cm. There are four rows of wheat in every furrow (fig. 2). Single or double disk opener is still being used. Some planters adopt a seperated pair of disk opener to apply fertilizer deeply and efficiently. The press wheel of furrow planters shapes like a waist-drum. When irrigating, water runs through the furrow from upper reaches, water and time are saved.

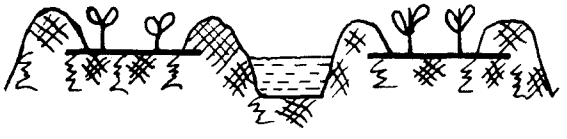

Fig. 3. Furrow irrigation

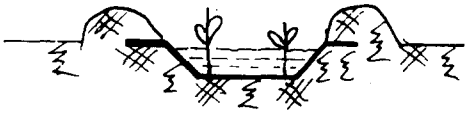

Fig. 4. On-film irrigation

ON-FILM IRRIGATION DRILLS

In the beginning, film was covered flatly over seed bed. Water runs beside the furrow (fig. 3), water application is great and the utilization ratio is low. (Liu yong hai 1990). Later, ridge-former and press wheel are added to the film laying machine in order to make the furrow shape like a ⌣ (fig. 4). On-film oozing irrigation can then be realized.

On-film irrigation drill (fig. 7) is made of road-wheel 1、ridge-former 2、fertilizer opener 3、film laying wheel 4、film pressing wheel 5、front soil covering disk 6、hill-dropper 7、rear soil covering disk 8、press-wheel 9、seed box 10、film roller 11、fertilizer box 12 and frame supporter. On addition to ridge former 2 and press wheel 3, there is no difference between the rest units and those of the ordinary film covering drill. The ridge-former consists of dozing plates, fertilizer opener and coupling device. The dozing plate has a certain working angle in order to form ridges. The fertilizer opener is easy to diving being slantly fitted at the bottom of the dozing plates. The front vertical axis of the ridge-former is adjustable with the rear part swivelled to the frame and pressed by spring so that the rear part of ridge-former can trace the earth surface. Ridges are pressed by press wheel to avoid collapsing during irrigation. Four -spacings or six-spacings can be powered by 40kw tractors.

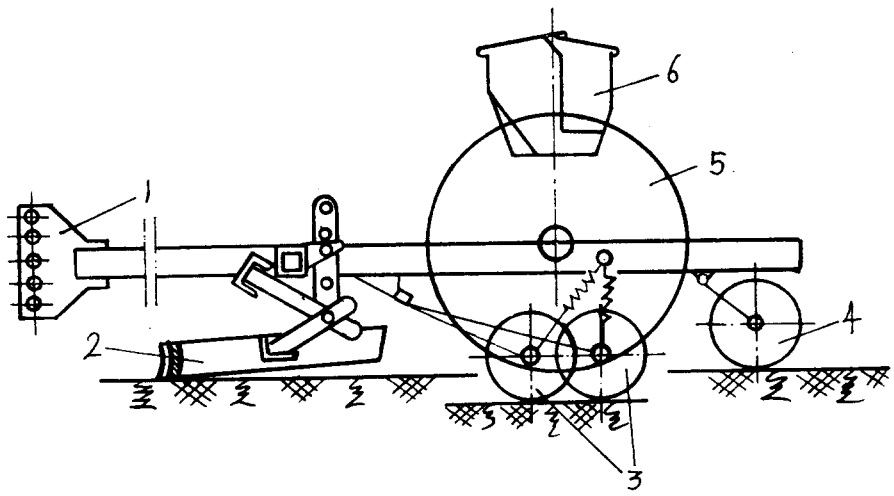

Fig. 5. Border irrigation drill

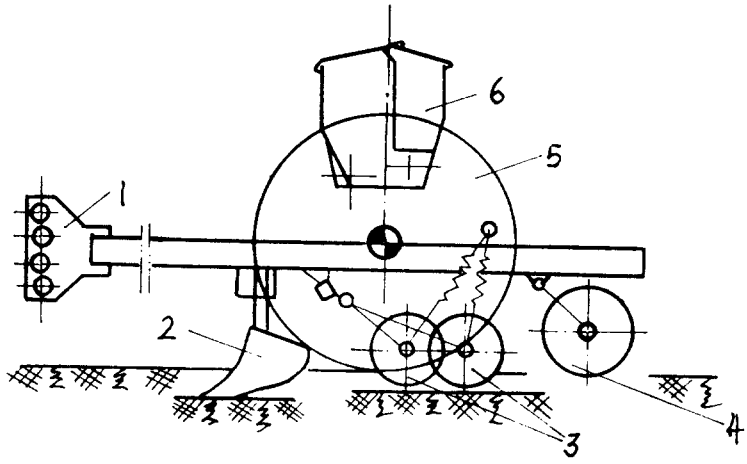

Fig. 6. Furrow irrigation drill

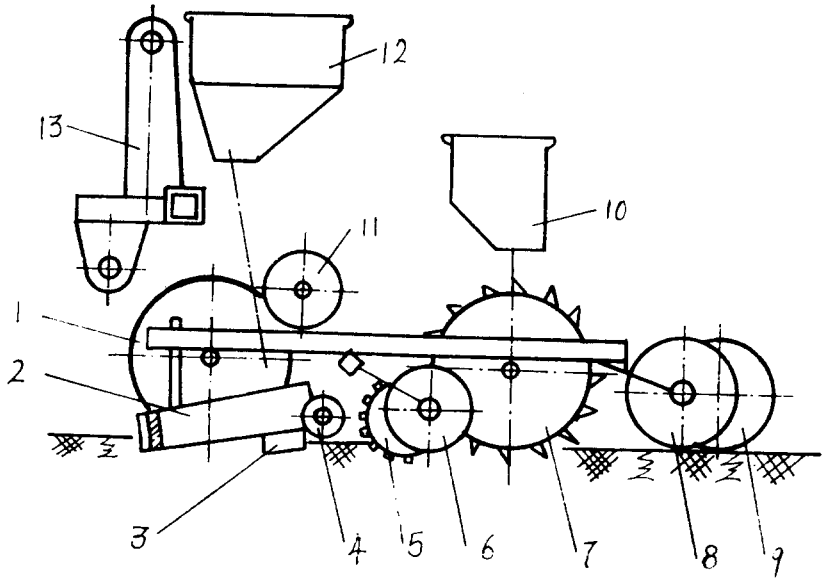

Fig. 7. On-film irrigation drill

CONCLUSIONS

1. Furrow planting and furrow irrigation have following advartages:

(1) Increase the ability of water retaining and temperature holding.

In spring, water content in 40cm depth of soil for winter wheat furrow drilled is 24% more than bed drilled. This is due to highgr snow accumulation and less vaporation in furrows. Therefore, the spring drought caused by water shortage for crops irrigation can be greatly moderated. Generally, water is saved by 26% compared to bed drilling.

(2) Make better use of fertilizer.

There are higher nitrogen content in the furrow planting field than in bed planting field by 9.6～11.65ppm. And the ultization ratio of nitrogen and phosphorus increase by 13.8～19.3%.

(3) Hold soil temperature and avoid the harm of frost.

In winter, wheat is protected by covering snow in furrous from the harm of frost. The soil temperature on 5cm depth is 0.3～0.8℃ higher than on ridges.

(4) Decrease the harm of saline-alkali.

The saline-alkali content in furrows can be decreased when water floats the saline-alkali toward ridges. Seed germination rate then increases by 25.5～36.5% higher than bed irrigation. As a result, the yields increase by 16～24%.

2. There are following advantage for film covering planting and on-film irrigation.

(1) Save water efficently.

On-film irrigation saves 690m^3/ha water more than furrow irrigation through measurement. when measured a week after irrigation, water

content on soil under 15～20cm is 12% for furrow irrigation and 15% for on-film irrigation, under 20～25cm they are 9.3% and 13% respectirely.

(2) Improve the damp & hot effect of soil.

The average temperature for 0～20cm depth of soil is 0.32℃ higher than furrow irrigation field, measured ten days after irrigation. On-film irrigation gives full play to the increasement of temperature which features plastic film. With soil water under film and greater hot capacity and steady soil temperature, the temperature difference between noon and night is 0.72℃ while it is 1.5℃ for furrow irrigation. With these advantages, seedlings can be sowed easly and emerged easly especially for strong seedlings.

By late June, on-flim irrigated cotton increases 0.83～1.1cm every day while furrow irrigated cotton 0.6～0.73cm.

(3) Use implements conveniently and efficiently.

On-film drill are efficient in that it can complete a set of farming in one time. It includes fertilizing、ridges forming、furrows opening、film laying、holes opening and soil covering and pressing. Thus plants can be sowed in good time when soil is kept moistured in spring season.

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