Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 14, Issue 2, 2014
PRINT ISSN 2284-7995, E-ISSN 2285-3952

SECTION FOR THE SEEDLING PLANTING MACHINE IN NUTRITIVE POTS

Olimpia PANDIA[1], Ion SARACIN[2], Ion BOZGA[1], Daniel NIJLOVEANU[1]

[1]University of Agricultural Sciences and Veterinary Medicine, Bucharest, Romania Faculty of Management, Economic Engineering in Agriculture and Rural Development, Slatina Branch, 150, Strehareti Street, Zip Code: 0500, Slatina City, Olt County, Romania, Phone: 0788391615;
E-mail: olimpia_pandia@yahoo.com, Phone:0745752957,
E-mail: nijloveanu_daniel@yahoo.com, Phone:0726148524
[2]University of Craiova, Faculty of Agriculture and Horticulture, 19 Libertatii Street, Craiova, Romania, Phone:0744162539, E-mail: ion_saracin@yahoo.com

Corresponding author: olimpia_pandia@yahoo.com

Abstract

The section is equipped with a mechanism for the movement transmission of several elements which are pot bearers, whose position to the soil in vertical plan remains constant to the slope of the terrain. It receive the rotation movement by Gall chain from a wheel which copies the soil and it presents the possibility of the adjustment of the distance between the plants in the row. The section may be a component of a seedling planting machine in pots in 1 – 2 rows, when the terrain is covered with foil mulch or from 1 to 6 rows on uncovered terrain. It may be a component of an agricultural aggregate for soil processing, for mounting foil mulch, for mounting hose for watering by processing. The transmission of the movement from the copy wheel presents the possibility of the adjustment of the revolution for the adjustment of distance between the rows, and the elements that support the pots bearer's parts present the possibility of the length modification in the same purpose.

Key words: *nutritive pots, seedling, planting machine*

INTRODUCTION

As a link of the technology of vegetable plants, the planting represents the most expensive part, which consumes time, power costs and quality of work. The time means the planting of the seedlings of the same species and age in the optimal term and in a short time. The power costs represent the mechanization of all the works represented by seedbed preparation and the avoidance of the manual planting. The quality of the planting represents the keeping of the distance between rows, the distance between pots in the row, the planting depth of the pots, the slight compaction of these and the watering, if necessary. All these requests can be fulfilled by the mechanization of the planting process of the seedlings sown in the pots. [1, 2]
Several rules of the seedlings planting are presented in the literature. Thus:
The seedlings are planted on prepared soil;
The seedlings must have approximately 45 days of vegetation, must be vigorous, healthy and weather-beaten in the moment of the plantation. [3]
The temperature in the soil must exceed 10 Celsius degrees at 10 – 15 cm in the depth;
The planting distance between the pots in the row and between the rows depends on the characteristics of the species and of the soil.
The planting depth of the pot is 7 – 15 cm depending on the species.

Table 1. Distance drills

The species	Distance between plants in row(cm)	Distance between rows
Cabbage	30-60	90-100
Eggplant	45-75	60-120
Pepper	30-60	90-100
Tomatoes	45-120	90-120
Melons	60-90	180-240

All the seedlings are planted in the same level where they were used as seedlings, except for the tomatoes and the eggplants.

The plantation is made with the planter, a little garden shovel or any other object that can make a hole large enough for the seedling not to be forced to enter.
The last rule is the avoidance of the effectuation of a planting section of the seedlings grown in pots

MATERIALS AND METHODS

The work presents a continuation of the studies and researches made for the obtaining of the seedlings in pots by direct sowing presented in the article „Studies regarding the effectuation of an pneumatic equipment for the sowing of little seeds in alveoli", published at the Internaţional Symposium ISB-INMA TEH 2013 by Saracin Ion and collaborators, which is the object of patent request registered at OSIM nr. A/00816/2013 in which the authors propose to effectuate a machine for the sowing of the little seeds in pots at depths between 0.6 and 3.3 mm depending on the species. [4]

RESULTS AND DISCUSSIONS

The seedling obtained in the pots must be planted after approximately 45 days from the emergence in the optimal period in conditions requested by the greenhouse, solar or in field culture technology in shorts periods of time not to influence the instalment growth of the plants.
The idea of the effectuation of the planting section started from the process of the operation of the reel which equips the aggregates for the cereal harvesting.
The pallets of the reel are equipped with fingers for the elevation and supporting in vertical position of the plants and have fixed position in vertical plan to the soil.
The supporting part of the pallets equipped with two rotating elements mounted eccentric is used for the execution of the section.
Their eccentricity may represent the operation depth of the section. From a constructive point of view the section is formed of: framework, equipped with the possibility of the attachment to a grip device to a tractor by articulation which permits the copy of the soil, a pneumatic wheel in the posterior part articulated at the framework of the section with the possibility of the adjustment in vertical plan and of its constant maintenance, the device with eccentric formed from two octagonal elements articulated at the corners between them, mounted to a arbour which receive the movement by Gall chain and notched wheels from the soil copy wheel which also effectuate the slight compaction of the soil next to the pots planted in the soil.
The cups are mounted on the eight corners of the device with eccentric and they are formed of a fixed part which makes the depth in the soil and a mobile part (the bottom of the cup) articulated at the fixed part and equipped with a leverage where an special construction arch can be found which keeps the bottom on closed position. During the operations the leverage is acted by a cam fixed in the inferior side of the eccentric device which opens the cup, leave the seedling and after the elevation (above the height of the seedling) the cam releases the leverage of the mobile bottom which is brought in closed position with a precise velocity effectuating the elimination of the possible residues left in the cup in this way.
The transmission of the machine, which is also simple, may assure at least two rapports of transmission of the movement towards the planting device.
In this way, the adjustment of the distance between the plants can be obtained between 20 and 40 cm by the removal of some cups or, for bigger distances, by modifying the transmission ratio.
The construction of the section and the operations process
The section is equipped with an arbour on which 3 rosettes sustained by a metallic plate fixed on the arbour are mounted.
The rosettes assure the eccentricity of one of the octagons to the arbour of the section. This receives the rotation movement from the soil copy wheel and its compaction next to the pots.
The two octagons are linked by articulation elements equipped with squared-section holes inside. In these holes the cups which transport the pots can be mounted and realizes the hole where the pot is left in vertical position.

The cups have two movements during the process: a V translation movement, given by the displacement velocity of the section and a rotation movement to the arbour of the section which has the angular velocity ω.

$$\omega = \frac{\pi \times n}{30} \left[\frac{rad}{sec}\right] \quad (1)$$

where n is the speed of the arbour.

The trajectory described by a cup mounted on the articulation element between the two octagons depends on the ratio between Vt and Vc.

Where, $V_c=R\omega$, R being the distance from the center of the section arbour to the grip point of the cup on the articulation element and the Vc the peripheral velocity of the cup.

The ratio Vc/Vt=1, because at the entrance and the exit from the soil the cup must have a vertical position, as well as on the whole circumference of 360 °.

The movement of a cup to the soil is analysed for the study of the section functioning.

We consider the cup A a point on the circumference of the circle described by it during the operations.

The trajectory pf the point A in plan can be described at a random point by the next equations:

$x=V_t \cdot t+R \cos \omega t$ (2)

$y=H+h-R \sin \omega t$

Where:

H is the height of the axis of the section to the soil

R Is the radius of the circle described by the cup

h is the planting depth

ωt=φ, represents the rotation angle of the cup after a random time t.

The equations of the velocity components are:

$$V_x = \frac{dx}{dt} = V_t - \omega R \sin \omega t \quad (3)$$

$$V_y = \frac{dy}{dt} = -\omega R \cos \omega t$$

Vx represents the horizontal component of the cup in horizontal plan.

Given the fact that the ratio between Vc/Vt=1, results that $V_t=V_c= R \cdot \omega$ or from the equation:

$V_x = \frac{dx}{dt} = V_t - \omega R \sin \omega t$, the term $\omega R \sin \omega t=0$.

For the plant to be left in vertical position in the soil, the projection of the absolute speed on the displacement direction of the section when the cup enters in the soil must be null, so:

$V_t - V_c \cdot \sin\varphi_1=0$ (4)

Where: φ_1 is the penetration angle of the cups in the soil.

or: $\sin \varphi_1=V_t-V_c=1$ (5)

Taking into account that $\varphi_1= \omega t_1$ results that: $\omega t_1=\arcsin 1$, which is equal with 90.

The speed of the octagons is determined by the peripheral velocity of the cups which must be correlated with the velocity of the section displacement, so that the ratio $\frac{V_c}{V_t} = 1$ remains constant on every point of the trajectory.

The variation of the distance between the plants in the rows depending on the transmission ratio from the operation wheel and the arbour of the planting device at the peripheral velocity of 1.5m/min is presented in Table 2.

Table.2.The variation of the distance between the plants in the rows depending on the transmission ratio from the operation wheel and the arbor of the planting device at the peripheral velocity of 1.5m/min.

No.	Transimssion ratio [%]	The distance between plants in the row [cm]
1	1	20
2	0,6	33
3	0,5	40
4	0,4	50
5	0,3	66
6	0,2	100

Note: By reducing the number of cups of the planting device (symmetrically) the distances between the plants, presented in Table 1, doubles as values for the same transmission ratio.

Table.3.The variation of the peripheral velocity of the cups depending on the speed of the arbour

No.	The speed of the arbour rot/min]	The peripheral velocity [rot /min]
1	30	1,5
2	35	1,85
3	40	2,05
4	50	2,6
5	55	2,8
6	60	3,2

Note: The peripheral velocity influences the uniformity of the plantation by the way of feeding of the cups with seedling

CONCLUSIONS

The seedling produced in pots planting section assures the planting uniformly on the row regarding the distance between plants and the depth of sowing.
The uniformity of the planting depends on the peripheral velocity of the cups and the reaction rate of the user.
The seedling produced in pots planting section can be a component of a planting machine equipped with two, four or six sections.
The planting device has the possibility of the adjustment of the cup position in vertical plan during the operations.
The soil copy wheel has the possibility of the resumption of the planting depth.
The cups present the possibility of planting pots of different shapes and sizes due to their form.
The mechanized planting reduces the plantation time, assures high productivity with minimal costs, and assures the possibility of mechanized effectuation of other operations in the vegetation period of the culture.

REFERENCES

[1]Bădescu, M., et al., 2003, Maşini agricole, Ed.Sitech, Craiova
[2]Glodeanu, M., Alexandru, T., Sărăcin, I., 2001, Îndrumător privind utilizarea maşinilor şi echipamentelor agricole, Ed.Aius, Craiova
[3]Marinescu, A., 1989, Tehnologii şi maşini pentru mecanizarea lucrărilor în cultura legumelor de camp, Ed. Ceres, Bucureşti
[4]Saracin, I., et al., 2013, Studies regarding the effectuation of pneumatic equipment for the sowing of little seeds in alveoli Internaţional Symposium ISB-INMA TEH, is the object of patent request registered at OSIM nr. A/00816/2013