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Meccanizzazione Agricola**



**European Network for Testing
of Agricultural Machines**

**AGRICULTURAL MACHINES FUNCTIONAL
AND SAFETY TESTING SERVICE**

TEST REPORT No. 04 - 003



PRECISION PNEUMATIC PLANTER: MTI

MANUFACTURER: GASPARDO SEMINATRICI S.p.A.
Via Mussons, 7 – 33075 – Morsano al Tagliamento (PN)

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TESTS CARRIED OUT IN COMPLIANCE WITH ENAMA SPECIFICATIONS NO. 04 BY
EXPERIMENTAL INSTITUTE FOR AGRICULTURAL MECHANISATION, MONTEROTONDO - ROME.

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To facilitate interpretation of the results, it should be remembered that:

1 Mpa	= 1000 kPa \approx 10 bar \approx 10 kg _{force} /cm ²
1 kW	= 1.36 CV
1 m/s	= 3.6 km/h
1 daN	= 1,.02 kg _{force}
DM	= dry matter.

DESCRIPTION OF MACHINE

The precision pneumatic planter manufactured by the company Gaspardo Seminatrici, model MTI, is an implement mounted via a three-point hitch to a tractor endowed with a lift unit and rear PTO. It is used on both tilled and untilled land to sow single seeds lined up in a row at predetermined distances, in particular maize, soya-bean, sunflower and beet seeds but also small-sized seeds (candied tomato, spinach, green pea, green bean).

Despite having a full width of 5.5 m, the implement's frame folds up using a hydraulic system, making it possible to fold up the side parts to the centre and reduce the width to 2.75 m for road circulation. The folding parts of the plant "float" during planting operations, making it possible to work on soil that is not perfectly flat. Operated by two two-stage cylinders, it is possible to line up the three frames when the planter is lifted to facilitate row-turning manoeuvres.

The implement consists of a main frame positioned crosswise to the forward direction of the tractor, on which are mounted fertiliser and pesticide tanks, an extractor unit powered by the PTO of the tractor at 540 rpm, row tracer bars and finally 8 independent seeding units capable of sliding along the frame in order to vary sowing distances among the rows.

Each seeding unit is in turn made up of a loading seed box, a seed distributor and tools to open and close the furrow and adjust the sowing depth; it may be closed and lifted from the ground using an ad hoc hooking device. It is connected to the frame by a jointed parallelogram suspension system, with which

vertical movements ensure that the implement remains flush to the land in order to keep the sowing depth constant.

Also connected to the frame are 4 pneumatic drive wheels for gripping the soil which, via three gear boxes, transmit a rotating movement to the feed unit. The sowing distance for the row may be varied, using the gear change (14 gears), the gear pair of the drive wheels and the sowing disc. The sowing discs basically differ in relation to the number of equidistant holes (20, 26, 36, 52 and 72 depending on the investment) and the diameter of the hole (depending on the calibre of the seed); the disc's axis of rotation is horizontal.

The seed box, prism-shaped and made from a plastic material, has a loading capacity of about 32 l of seeds, it has a metal lid on top and a lower hatch for unloading remaining seeds; it communicates directly with the sowing disc.

Seeds are distributed via a depression created by the centrifugal extractor on each seeder unit which, while the disc is rotating, keeps hold of only one seed per hole thanks to the presence of three mechanical selectors, which cause excess seeds to fall. One face of the disc is in contact with the seed contained in the seed box, while the other face is in contact with the extractor unit. The seeds remain close to each hole throughout the duration of the suction effect in the feed and distribution phases, and they subsequently fall into the furrow opened in the soil via a special seed tube.

The furrow is opened by a furrow opener, consisting of a pair of metal discs, preceded by a clod remover and a point capable of removing large clods present in the seed-bed.

The sowing depth is adjusted using a pair of metal wheels covered in rubber and endowed with soil scraper, placed on the sides of the furrow discs, while the subsequent closing of the furrow and compression of the soil to ensure the adhesion of the seed is performed by a pair of inclined rubber wheels.

Finally, the row tracer parts, placed lengthways to the planter (crosswise to the forward direction) and consisting of parts of varying length and inclination, can be closed hydraulically from the driver's seat, and return vertically within the planter's profile during transport.

They have the job of tracing a reference line on the land, parallel to the tractor's passage, which will be followed by the tractor during the return passage in order to avoid overlapping between one passage of the machine and the next. The machine is shown in figures 1 and 2.

ACCESSORIES

The manufacturer has declared that the following optionals are available:

✚ *electronic hectaremeter*: equipped with monitor, it automatically records the number of hectares sown, with both the partial and the total figure;

✚ *row breaker anchors*: these have the job of breaking up soil compressed by the tractor's tyres;

✚ *1" or 2" "V" inclined covering wheels*: rubber, cast iron or farmflex;

✚ *rubber compression wheels*: with diameter of 370 mm;

✚ *drive wheels 7.50 - 16 and 5.00 - 15*;

✚ *free-wheel dual drive*;

✚ *block for tractors with PTO at 1,000 rpm*;

✚ *double-disc or seed-harrow driller to inter fertiliser*;

✚ *hydraulic foldaway frame with closure at 2.55 m*;

✚ *front and rear coverers*;

✚ *additional stainless steel small wheel*.



Figure 1 – Diagram of the tested machine and its parts (side view):

1) seed loading box; 2) pesticide tank; 3) row tracer bar; 4) drive for fertiliser spreader; 5) shaft to transmit drive to distributor; 6) clod pusher; 7) dual disc furrower; 8) distributor; 9) wheels to adjust sowing depth, with soil scraper; 10) compression wheels.

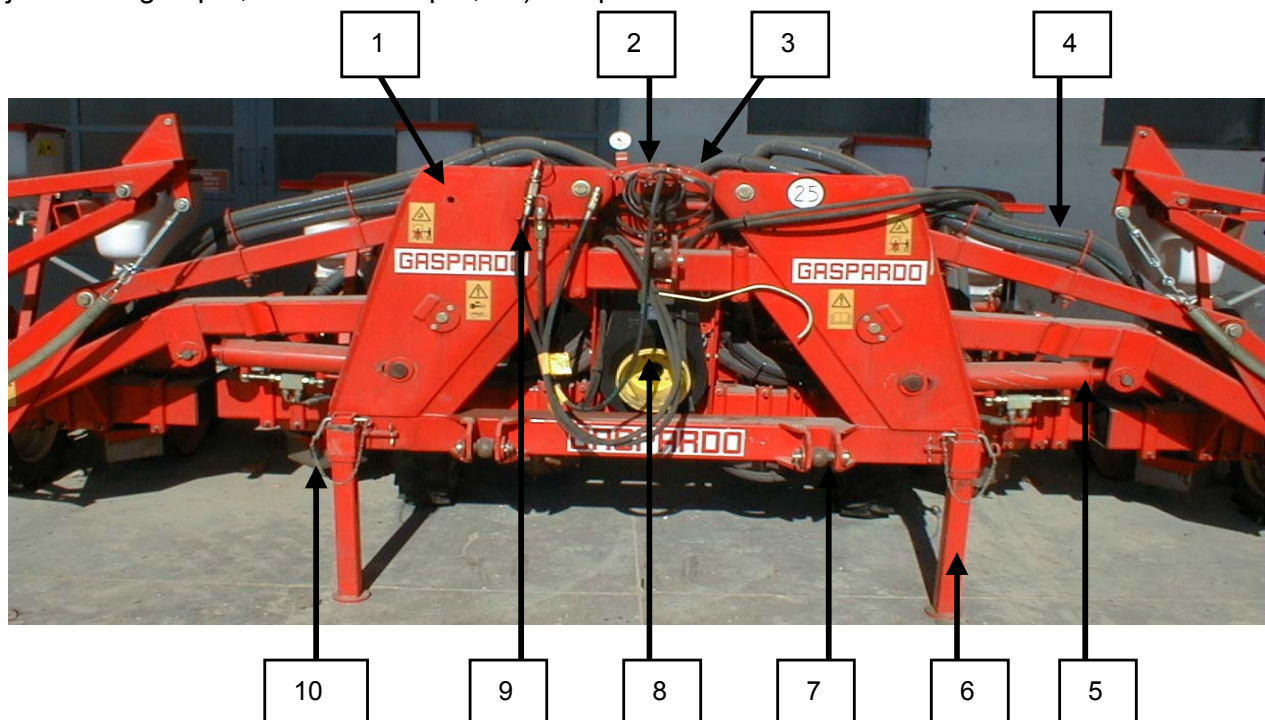


Figure 2 – Diagram of the tested machine and its parts (front view):

1) support for tractor's three-point hitch; 2) 3rd point hitch; 3) extractor unit; 4) flexible hosing for transfer of extractor's air flow to distributors; 5) hydraulic cylinder for closing of side sections in transport position; 6) support base; 7) connection to lower arms of tractor lift; 8) power take-off with protection of cardan shaft; 9) hydraulic points; 10) drive wheel to operate distributors.

TECHNICAL DATA**SERIAL NUMBER OF TESTED MACHINE: 0063**

Size	working position	transport position
total width (mm)	5510	2750 (foldaway sections)
total length (mm)	2030	2190
total height (mm)	1520	3550
working width (mm)	6000	
Main frame		
type	special-shaped drawn tube.	
Wheel drives		
number		4
pneumatic measure		6.5/80-15
diameter full outside (mm)		650
running radius (mm)		360
wheel-shaft guiding gear		16-23 teeth
Seed boxes		
type	plastic, prism-shaped;	
number		8
capacity (l)		32
capacity per m of working width (l/m)		42.7
filling height from ground (mm)		1200
Seeder units		
number		8
distance between rows (mm)		750
width of depth adjuster wheel (mm)		115
diameter of depth adjuster wheel (mm)		400
diameter of drill disc (mm)		374
diameter of covering device wheel (mm)		320
Sowing discs		
type	perforated disc rotating on horizontal axis;	
diameter of disc (mm)		220
number of holes		26
diameter of hole (mm)		4,75
Gearboxes		
number		3
number of gearwheels of driving shaft		2 (16 and 23 teeth)
number of gearwheels of driven shaft		7 (17 ÷ 23 teeth)
Row breaker bars		
length of bar (mm)		2800
diameter of disc (mm)		348

Extractor unit

Operation via belt and pulley powered by tractor's PTO;

Measured mass

total, empty (kg)	1600
total, full load (kg)	1824

TEST CONDITIONS

The Gaspardo precision pneumatic planter, model MTI, was subjected to field tests at the Experimental Institute for Agricultural Mechanisation of Monterotondo (Rome) from 11 to 13 March 2003. The planter had standard drive wheels 6.50/80-15, while the feed units had seeder discs with 26 holes suitable for planting maize.

encoder that measures the number of turns of the tractor's rear wheels to calculate wheel slip; a single-axle load cell, using traction and compression, of a strain gauge type, to measure the tensile force required by the implement (placed between the tractor to which the implement is coupled and a brake-van, which pulls the former at a speed equivalent to the working speed).

TRACTOR USED

To operate the implement a four-wheel drive tractor was used, having a rating of 110 kW and overall mass of 6,000 kg. The PTO speed was selected at 540 rpm (corresponding to 1,944 rpm of drive shaft). The tractor had an ISO category 3 three-point hitch and was equipped with 480/65 R 28 front tyres and 600/65 R38 rear tyres.

TEST GROUND

The test ground was a series of flat plots of land that had previously been ploughed to a mean depth of 0.40 m with a mean superelevation of 0.15 m, and subsequently broken down further using a rotary tiller. Before the planter was used the following measurements were taken (table 1): granulometric composition, relative humidity (from 0 to 0.3 m), the apparent density of the soil and penetration resistance for the layer subjected to seeding operations (from 0 to 0.4 m).

INSTRUMENTATION USED

For field tests an instrument chain formed by a series of sensors fitted to the tractor was used: a torsionmeter with relative signal conditioning unit to measure the torque transmitted and the PTO speed of the tractor; a digital

Texture	
skeleton (%)	0
sand (%)	2.6
lime (%)	48.0
clay (%)	49.4
Atterberg limits	
liquid limit (%)	46.2
plastic limit (%)	27.9
plasticity index	18.3
Humidity	
From 0 to 300 mm (%)	23.4
Mean penetration resistance (MPa)	0.79
Mean apparent density (g/cm³)	1.4

Table 1 – Physical-mechanical properties of test ground.

PROPERTIES OF SEED USED

To analyse the functionality of the MTI pneumatic planter, the hybrid first-generation maize seed, variety DK 743 (table 2) was used.

To determine crosswise and longitudinal unevenness coefficients, the apparent voluminal mass (expressed in g of DM/dm³) and the mass of 1,000 seeds (expressed in g of DM) were calculated, the averages of which are given in table 2.

length of vegetative cycle (days)	135
germinability (%)	91
purity of seed (%)	99
calibre	GR2
voluminal mass apparent (g DM/dm ³)	768,1
mass 1,000 seeds (g DM)	404,5

Table 2 – Properties of seeds used for testing.

RESULTS OF TESTS

After having established the tractor’s most appropriate forward speed for the tractor and engaged dual traction and the differential lock, the operative characteristics, referring to one hectare, were determined, as shown in table 3.

Tests were based on field passages with the seed box full (2.24 quintals of seed), with a concentration of 77,071 seeds/ha sown at a depth of about 40 mm and with a sowing distance of 173 mm along the row and 750 mm between rows.

The average level of depressor suction was kept at values of –65 mbar during testing, in accordance with the manufacturer’s recommendations in the planter’s user handbook for the type of seed used.

Table 3 shows a specific tensile strength of about 77.8 daN/row, resulting in power absorbed to pull the implement of 14.1 kW, operating at an optimal forward speed for this type of planter.

Tractor slip was modest, within normal limits for the equipment being tested:

fuel consumption per unit of time was 12.6 kg/h, and per surface area unit 2.52 kg/ha (with reference to actual work time).

In such conditions the operating capacity of the planter was 33,600 m²/h, thanks in part to the low incidence of time taken to turn around in the field and to refill seed boxes.

It can also be seen from the table that the actual working width was 6.0 m and the operating width 5.97 m, with a working width utilisation ratio of 99.5%.

The actual average sowing depth was in line with the set theoretical value, and the average distance between seeds along the row constantly deviated by 3.5% from the theoretical value as defined in the calibration chart.

<i>Elements</i>	<i>Performance</i>
tractor gear	10 th normal
average suction value of vacuum gauge (mbar)	-65
average engine speed (rpm)	1821
PTO mean rpm (rpm)	506
actual working width (m)	6.00
operating working width (m)	5.97
working width utilisation ratio (%)	99.5
soil break-up index after tilling	0.81
surface roughness index for broken soil	2.11
average sowing depth (mm)	40
average actual sowing distance along row (mm)	179
actual working time (h/ha)	0.20
actual mean speed (m/s)	2.27
actual working capacity (ha/h)	4.90
operating capacity (ha/h)	3.66
operating yield	1.34
hourly fuel consumption (kg/h)	12.6
unit fuel consumption (kg/ha)	2.52
average tensile force (daN)	622
traction capacity required *(kW)	14.1
average PTO torque (daNm)	7.2
average power required of PTO by the extractor unit (kW)	3.8
total mean power required (kW)	17.9
power supplied to tractor engine (kW)	45.1
tractor wheel slip (%)	3.6

(*) global power expended for machine traction, excluding losses of transmission due to wheel-spin, wheel slip and the power required for the tractor's hydraulic functions.

Table 3 – Average results obtained with MTI Gaspardo Seminatrici precision pneumatic planter during seeding field testing.

<i>Uniformity and efficiency indexes</i>	<i>Performance</i>
Crosswise unevenness coefficient (%)	1.63
Longitudinal unevenness coefficient (%)	6.13
Uniformity of hole filling (%)	100

Table 4 – Average results obtained with MTI Gaspardo Seminatrici planter during field testing with maize seed.

Table 4 shows an appraisal of the planter’s operating performance during the course of field testing. The implement recorded a crosswise unevenness coefficient of 1.6% and a longitudinal unevenness coefficient of 6.1%.

NOTES ON FUNCTIONALITY

Under the operating conditions recommended by the manufacturer (-65 mbar), the implement proved itself capable of adequately preparing the seeding furrow and interring the seed. The amount of seed actually distributed per hectare deviated from theoretical value, as per the calibration chart defined prior to field testing with the seed box full, by about 6.1%. This value can however be reduced by adjusting the number and diameter of sowing disc holes to the size of the seeds and by appropriately combining gears in the gearbox, as shown in the user and maintenance handbook. The amount of seed distributed by each seed tube in the drill shows a negligible unevenness of crosswise distribution, demonstrating the correct functioning

of the pneumatic system for distributing seed.

The depth at which seeds were sown conformed to recommended values, thanks in part to the side rubber wheels that rested on the ground.

The precision pneumatic planter, model MTI manufactured by Gaspardo Seminatrici, can be used by holdings of an adequate size and by farm contractors, since despite having a working width of 6.0 m, suitable in any case for tamping soil due to the fewer number of passages, it offers an actual operating capacity of 3.7 ha/h. The ease of manoeuvre when turning around, reducing “down” times, and the ease with which seed boxes can be filled make it possible to seed 6.5 ha of land before the planter needs to be refilled.

Coupling with the 110 kW tractor appeared to be appropriate for the test conditions, although the manufacturer has declared that a less powerful tractor should be sufficient.

REMARKS AND INSTRUCTIONS

The implement is endowed with instruction and maintenance handbook in compliance with existing law provisions.

ROAD CIRCULATION

For the purposes of the Highway Code the machine is classified as a exceptional mounted agricultural machine, and is therefore an integral part of the tractor (art. 57, Legislative Decree 285 of 30/04/1992), does not require type approval and may circulate on the road only as exceptional transport. The implement may also be transported using an ad hoc type-approved trailer.

TESTING OF SAFETY REQUIREMENTS

The machine is endowed with CE marking, an identification plate, safety pictograms, a user and maintenance handbook and an EC manufacturer's declaration of conformity.

The EC manufacturer's declaration of conformity certifies that the machine conforms to the following harmonised standards and technical specifications: UNI EN 294:1993, UNI EN 982:1997; UNI EN 1553:2001; ISO 11684:1995.

Checks carried out with reference to documentation sent by the manufacturer did not show up inconsistencies with the contents of the aforementioned standards.

The relative documentation has been filed.

THE PRESENT TEST REPORT IS VALID UNTIL REFERENCE REGULATIONS CHANGE FOR THE PNEUMATIC PLANTER MOD. MTI, MANUFACTURER: GASPARDO SEMINATRICI S.P.A.

THE PRESENT TEST REPORT IS OFFICIALLY RECOGNISED BY THE FOLLOWING ENTAM MEMBERS WITH THEIR RELATIVE RECOGNITION NUMBERS:



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