



**Ente Nazionale  
Meccanizzazione Agricola**

**ENTAM**

**European Network for Testing  
of Agricultural Machines**

**TESTING SERVICE OF FUNCTIONAL AND SAFETY  
CHARACTERISTICS OF AGRICULTURAL MACHINES**

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**TEST REPORT n. 03 - 036**



**SPADING MACHINE: 3012G**

**MANUFACTURER: SELVATICI FRANCO**  
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**Rome, November 2001**

TESTS CARRIED OUT IN CONFORMITY WITH ENAMA METHODOLOGY N. 03 AT THE “ISTITUTO SPERIMENTALE PER LA MECCANIZZAZIONE AGRICOLA” - MONTEROTONDO, ROME, BY:

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FOR BETTER CLARIFICATION AND INTERPRETATION OF THE RESULTS, PLEASE NOTE THAT:

- ◆ 1 MPa = 1000 kPa = 10 bar  $\approx$  10 kg<sub>force</sub>/cm<sup>2</sup>
- ◆ 1 daN  $\approx$  1.02 kg<sub>force</sub>
- ◆ 1 kW = 1.36 CV
- ◆ 1 m/s = 3.6 km/h

## DESCRIPTION OF THE MACHINE

The Selvatici spading machine, model 3012G, is a mounted agricultural machine used for the main preparation of the soil prior to the successive work of refining and preparation of the seedbed. The machine is driven using the tractor's power take off and by a system of oscillating levers and gear-

ing which activate spade shaped devices; these penetrate the ground surface alternately, completely turning over the soil. The spading machine under examination, with a theoretical working width of 3.0m belongs to the "220.320" series, comprising 8 models with a width which is variable from 2.5m to 4.5m.

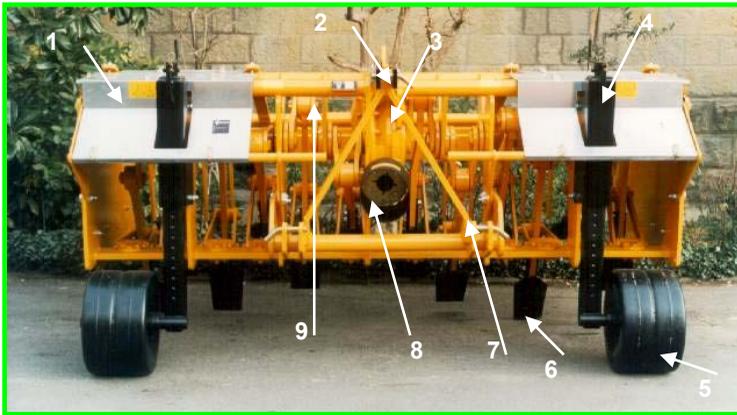


Diagram 1 – Plan of the tested machine and its components: 1) Upper protection casing; 2) Upper link connection; 3) Three speed reduction gearbox; 4) Working height wheel adjustment; 5) Working depth regulating wheel; 6) Trapezoidal spade tools; 7) Tractor's lower link connection; 8) Power take off with cardan shaft protection; 9) Articulated parallelogram bridge of the connecting rod.

## ACCESSORIES

The machine can be fitted with:

- ◆ *wheel for regulating the working depth (in replacement of the standard skid);*
- ◆ *a bonnet opening system consisting of two hydraulic cylinders;*
- ◆ *three point connection and power take off for operating additional equipment (rotary tiller, rotary harrow, etc.)*

**TECHNICAL DATA**

**TESTED MACHINE SERIAL NO. 4080**

**DIMENSIONS**

	working position
Total width (mm)	3000
Total length (mm)	1900
Total height (mm)	1600

**FRAME**

type	box-type in sheet and steel plate
tractor coupling	three point connection cat. ISO II and III

**TRANSMISSION OF DRIVE**

from the p.t.o.	cardan shaft with torque limiter
main transmission	gearbox with helicoidal gearing in constant drive in an oil sump (9-39 teeth)
tools transmission	straight toothed rear bevel gears to enable variable rotation speeds of the spades based on the gear speed chosen
p.t.o. speed	1000 rpm

**STANDARD TOOLS**

type	trapezoidal steel spades
total no.	12
maximum thickness (mm)	30
minimum thickness (mm)	18
height (mm)	285
axle base between spades (mm)	250

**NOMINAL DIMENSIONS OF THE WORKING LAYER**

maximum width (mm)	3000
maximum depth (mm)	400

**ROTATION SPEED OF THE SPADES**

	p.t.o. 1000 rpm
Standard gearing (13-22 teeth)	137 rpm in 1 <sup>st</sup> gear
Standard gearing (15-22 teeth)	157 rpm in 2 <sup>nd</sup> gear
Standard gearing (16-20 teeth)	184 rpm in 3 <sup>rd</sup> gear

**AVERAGE POWER AT THE P.T.O. (kW)**

70-103

**OVERALL TOTAL MASS (KG)**

without accessories	1900
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## TEST CONDITIONS

### TRACTOR USED

The machine was connected to a four-wheel drive tractor with the following characteristics:

- ◆ nominal power            176.5 kW
- ◆ total mass                9730 kg
- ◆ connection device    cat. 3 ISO

The rotation speed of the power take-off used for activating the spades, was set at 1000 rpm in correspondence to the 1903 rpm of the drive shaft.

### TEST GROUND

The tests were carried out on unbroken and level ground. The vegetal covering of the ground consisted of autumn-winter cereal residues (durum wheat).

Before tilling the following data was measured: the granulometrical composition, the relative humidity and the apparent density of the ground, and the penetration resistance of the working stratum (tab. 1).

skeleton (%)	<b>0</b>
sand (%)	<b>2.3</b>
silt (%)	<b>43.4</b>
clay (%)	<b>54.3</b>
liquid limits (%)	<b>62.2</b>
plastic limits (%)	<b>40.3</b>
index of plasticity	<b>21.9</b>
Humidity 0 m + 0.2 m (%)	<b>15.8</b>
Humidity 0.2 m + 0.4 m (%)	<b>16.8</b>
Apparent medium density (g/cm <sup>3</sup> )	<b>1.2</b>
Average resistance to penetration (kg/cm <sup>2</sup> )	<b>8.1</b>

Table 1 – Physical-mechanical characteristics of the test soil.

## TEST RESULTS

During the tests, after establishing the tractor's most suitable forward gear (1<sup>st</sup>), compatible with the characteristics of the test ground, 4-wheel drive was selected and the differential lock was inserted, the accelerator lever was adjusted to the maximum position, then the functional and operational characteristics (per hectare) were determined; reported in table 2.

The operational performance of the spading machine was evaluated at all three speeds of the reduction gearbox, using the drive taken from the tractor's power take off to activate the working components of the machine.

Table 2 shows the average specific power, using the three gear speeds of the central reduction gearbox, which are 0.55, 0.68 and 0.80 kW/m cm respectively (per metre of operational width and centimetre of working depth on the worked unbroken soil) operating with an adequate forward working speed, which was almost constant during the three tests, and with an average value of 3.04 Km/h, in line with the manufacturer's indicated values.

As expected for this type of machine, tractor slip was negative and varied between -2.5 and -9.5%, considering the push created by the spading machine, with the advantages of a greater exploitation of power and reduced fuel and tyre consumption.

The average hourly fuel consumption, expressed in terms of mass, was 25.2, 32.6 and 33.6 kg/h respectively for the three gear speeds, while consumption per surface unit was, however, 34.1, 43.5 and 44.8 kg/ha respectively.

In addition, the above-mentioned table shows how, in the three tests, the theoretical working width was used to 98.2%, while the average working depth on unbroken ground was 0.24 m

with an average crest of the terrain of 0.22 m.

As far as evaluating the quality of work carried out was concerned, in addition to determining the working depth and crest of the worked section, the degree of digging in of the vegetal matter was calculated (crop and weed residues), after having first determined the index of ground cover before and after the passage of the machine, shown by the ratio between vegetal surface cover and the ground surface. For this purpose a visual analysis was carried out,

through observation of the presence or otherwise of vegetal cover between the square mesh of a sheet of specific dimensions (1 m<sup>2</sup>) placed on the ground. The results obtained show how the spading machine turned over the ground effectively, and that the degree of digging in of the vegetal matter varied from 62.5 to 67.6%.

In addition, the residual sod level after digging was examined, using samples of soil subjected to riddling in a sieve, in order to obtain the subdivision of 6 dimensional classes (diagram 2).

<i>Elements</i>		<i>Performance</i>		
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>
average engine speed	(rpm)	2224	2213	2196
average p.t.o. speed	(rpm)	1168	1163	1154
shaft average working speed	(rpm)	158	186	214
theoretical working width	(m)	3.0	3.0	3.0
effective working width	(m)	2.80	2.80	2.80
operating working width	(m)	2.75	2.75	2.75
used working width	(%)	98.2	98.2	98.2
working depth of unbroken soil	(m)	0.25	0.23	0.24
stratum worked of unbroken soil	(m)	0.46	0.45	0.47
crest	(m)	0.21	0.22	0.23
worked section	(m <sup>2</sup> )	1.29	1.26	1.32
degree of digging in of vegetable matter	(%)	62.5	65.5	67.6
effective working time	(h/ha)	1.20	1.20	1.21
operational working time	(h/ha)	1.34	1.34	1.33
operational yield	(%)	89.5	89.4	89.4
average effective speed	(km/h)	3.03	3.04	3.06
operational working capacity	(ha/h)	0.74	0.75	0.75
hourly fuel consumption	(kg/h)	25.2	32.6	33.6
unit fuel consumption	(kg/ha)	34.1	43.5	44.8
average torque at the p.t.o.	(Nm)	57.1	68.8	85.4
average power at the p.t.o.	(kW)	69.8	83.7	103.3
specific average power	(kW/m cm)	0.55	0.68	0.80
power delivered to the tractor engine	(kW)	106.1	110.3	126.8
slip	(kW)	-2.5	-6.8	-9.5

Table 2 – Average results obtained with the Selvatici spading machine, model 3012G, using all 3 gear speeds available, during the working tests in the field on unbroken soil.

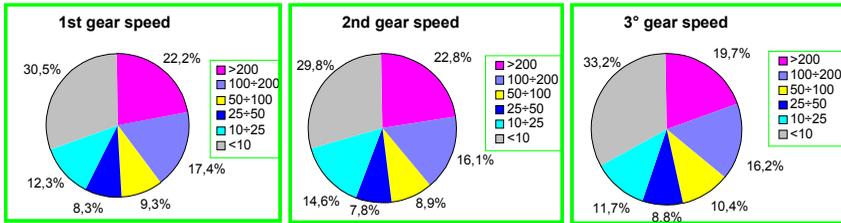


Diagram. 2 – Clod incidence of the soil after digging in using all three different operating speeds of the machine.

**COMMENT ON FUNCTIONALITY**

The Selvatici spading machine, model 3012G, has proven to produce, in only one passage, an optimal first working of unbroken soil, operating at the maximum working depth, on silt-clay soil. Good results can, therefore, be achieved on difficult ground conditions. Coupling to a 176 kW tractor was right for the hard test conditions. However, a less powerful tractor, like the one suggested by the manufacturer, could prove sufficient, particularly on less cohesive and less difficult ground.

**RECOMMENDATIONS AND INSTRUCTIONS**

The spading machine is supplied with a use and maintenance manual, which conforms to current regulations.

**ROAD CIRCULATION**

According to the Italian Highway Code the machine is classified as a mounted agricultural machine of exceptional dimensions and is therefore an integral part of the tractor (art. 57, legislation no. 285 of the 30/04/1992), it does not

require homologation and can transit only on exceptional regulations. Where the machine is placed on an approved trailer, in respect of overall dimensions and mass limits, then transit is on “non exceptional” conditions.

**SAFETY CHECK**

The machine is fitted with the CE mark, an identification plate, safety pictograms and is supplied with an use and maintenance manual and a declaration of conformity.

The declaration of conformity attests that the machine conforms to the following technical specifications and harmonised standards: UNI 10634:1998; progetto CUNA E03.23.835.0 del 17 ottobre 2001 (di revisione UNI 10634:1998); ISO 11684:1995.

From the analysis carried out and in relation to documentation sent from the manufacturer, there do not appear to be inconsistencies with what is reported in the regulations cited.

The relative documentation is deposited in the papers.

**THE PRESENT TEST REPORT IS VALID FOR FIVE YEARS OR UNTIL THE REGULATIONS REFERRING TO THIS ARE MODIFIED FOR ALL THE 3012G SPADING MACHINES AND RELATIVE EXTENSIONS, AND IS OFFICIALLY RECOGNISED BY THE MEMBERS OF ENAMA:**

**ASSOCAP (Associazione Nazionale dei Consorzi Agrari)  
CIA (Confederazione Italiana Agricoltori)  
COLDIRETTI (Confederazione Nazionale Coltivatori Diretti)  
CONFAGRICOLTURA (Confederazione Generale Agricoltura)  
UNACMA (Unione Nazionale Commercianti Macchine Agricole)  
UNACOMA (Unione Nazionale Costruttori Macchine Agricole)  
UNIMA (Unione Nazionale Imprese Meccanizzazione Agricola)**

**AS WELL AS BY BOARD OF GOVERNORS OF ENAMA IN WHICH THE FOLLOWING ARE ALSO REPRESENTED:**

**MIPAF (Ministero per le Politiche Agricole e Forestali)  
Regioni e Province Autonome  
ISMA (ISTITUTO SPERIMENTALE PER LA MECCANIZZAZIONE  
AGRICOLA)**

**THE TEST RESULTS ARE RECOGNIZED BY THE FOLLOWING TESTING STATIONS BELONGING TO ENTAM, WITH THE FOLLOWING NUMBERS:**



**DLG - Deutsche Landwirtschafts-Gesellschaft e. V. n° I - 4984  
(Eschborner Landstraße 122, D-60489 Frankfurt am  
Main, GERMANY)**



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