ABAC Holland

ABAC Holland develops **Saffron All in One** planting and harvesting machine

The experts of the Dutch firm ABAC Holland B.V. of Julianadorp, The Netherlands, have specialised in the entire production chain of Saffron for almost 30 years. The company combines the supply of Crocus sativus corms[1] with its know-how on soil preparation, preparing ridges to avoid the rotting of roots, irrigation, crop management, harvest and post harvest procedures, conservation of active ingredients of Saffron as well as marketing and sales. The company constantly works on innovation and quality improvement.

Saffron has a long, documented history going back at least to the ancient Greek Minoan civilisations on the islands of Crete and Thera (Santorini) where wall paintings in the palaces of Knossos and Akrotiri show Saffron being cultivated, harvested and applied as medicine.

Saffron is the world's most expensive spice, with a retail sales price of around € 20,000 per kilogram. This price is partly due to scarcity of the product. A glance at the pictures below tells us one of the reasons. The harvest of Saffron flowers that takes place close to the start of the winter season, is executed very much in the same manner as it was done thousands of years ago.

[1] Corms is the official name for the Crocus sativus corms.

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And right here lies a major problem for Saffron growers in practically all major Saffron producing countries. The harvest of Saffron is highly labour *intensive* and is concentrated in a short period of about 10 days time. The flowers open in flushes and have to be removed early in the same day. After being plucked, they have to be brought inside where the stigma, the actual Saffron, are removed from inside the delicate flowers.

But apart from this annual apotheosis during harvest, and despite the fact that the rest of the year Saffron cultivation is quite labour *extensive*, several other stages of the entire production cycle require detailed attention and hard work by many hands.

In the first place, in order to achieve good harvests, Crocus sativus corms should be seen as a rotational crop. In practice this means that, ideally, Saffron should not be cultivated for more than 4 years on the same field. So at least every 4 years the corms should be removed, selected and replanted in a different location. Ideally, only after a period of at least 10 years the same plot should be used to grow Saffron, if the farmer wishes to achieve the maximum yields.

An important aspect of Saffron cultivation is the preparation of the soil. Apart from mixing the soil with some harmless but beneficial fertilisers at the beginning, it is also vital to prepare for adverse weather conditions. As the climate world-wide is changing, even traditional Saffron production areas are confronted with new realities that were never a problem.

In particular heavy rain and water clogging can cause the roots of the corms to start rotting. In order to protect the roots from water, especially on soils that do not drain (too) well (enough), it is advised to grow the crop on ridges. Preparing ridges is often done manually. This is a very labour intensive task and if this task is not done in the right manner, the effect will be far from perfect.

In a world experiencing a population growth that causes ever more pressure on the availability of arable land, it is essential to maximise on the yield per Hectare. Therefore, after the ridges are prepared, it is of equally great importance to plant the maximum number of corms per square meter. Traditionally, planting is often done manually. The use of semi-skilled and unskilled labour often causes loss of efficiency in planting. As a direct consequence the yield per square meter is also far from optimal.

After planting, which takes place mostly during the months of August and September in the Northern Hemisphere[2], up to the time the crop appears above the soil and then again after harvesting through the year until the next harvest, it is crucial to have a disciplined weed control programme in place. This is where many growers are making mistakes by letting weeds become too dominant. At certain points in time, as our experience world-wide tells us, weeds can cause serious harm to the Saffron crop. Simply because weeds compete with the actual crop for nutrients. And this has a negative effect on the results, both in quality and in quantity. But then it is common to human nature to (temporarily) neglect weeds, thus negatively influencing the net results at harvest time.

Harvesting itself is not only labour intensive. It is also physically very demanding. Workers have to bend their backs for hours and for many days, causing severe back pain and gradually slowing down the pace of each worker. And those familiar with Saffron cultivation know that it is crucial during the very short harvest campaign to pluck the flowers each day at the earliest.

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[2] In the Southern Hemisphere, in new upcoming Saffron production areas such as Australia, New Zealand, South Africa and Latin America, planting would ideally take place in the months of February and March. Much depends though on climate data, especially regarding rainfall.

Looking for a comprehensive solution

For almost 30 years, the experts of ABAC Holland B.V. have cultivated Crocus sativus corms, grown Saffron and supplied their corms world-wide in countries like France, Spain, Morocco, Switzerland, Italy, Bulgaria, Ukraine, Iran, Afghanistan, Japan, Australia, New Zealand, Chile and South Africa.

During all those years, the need for streamlining and a certain degree of mechanisation has become ever more evident. It is therefore that ABAC Holland, together with partners in the sector and experts in the field of designing effective agricultural equipment that is robust, easy to operate and low in maintenance, has started the development of a machine called the Saffron All in One (SAIO).

The starting point in developing this machine was that it should be **multi-functional**:

- to be deployed for the construction of ridges
- for planting
- removal of weeds and
- harvesting.

A first prototype of the SAIO has been completed in 2015, as can be seen below:

A number of tests will be conducted on several locations in Europe. The tests will be conducted during the various phases in the production cycle of both Crocus sativus corms and Saffron as a spice in the fields:

1. uprooting / harvesting of bulbs in June
2. preparation of ridges before planting
3. planting of bulbs
   - in June: for Crocus sativus bulb cultivation
   - in August-September: for Saffron cultivation
4. harvesting of flowers in October / November
5. removal of weeds during crop management cycles throughout the year.

The tests will be conducted in several types of fields with several types of soil:

- sandy soil
- mixed soil
- clay
- heavy clay

and in all the above cases:

- soil with a lot of stones
- soil with few or no stones.

The issue of type of soil will be important because this will be of strong influence on the type and capacity of the engine that has to be employed.

All functions of the SAIO 1 will be studied in great detail. The functions are very diverse:

1. **Uprooting** and **collecting** of Crocus sativus **bulbs:** this is a relatively elementary function, less refined than some of the other functions the final version of the SAIO should be able to perform.
2. **Building of ridges**: After preparation of the land, with compost and fertilisers - a task performed with a tractor and plow for example, so not with the SAIO - the SAIO will be deployed to build ridges on the land. Depending on the type of soil and the actual condition of the soil, the ridges will be made 10 - 15 centimetres high. Ridges will be necessary especially in soil that not “well-drained”, i.e. where after rainfall the water will disappear within a short period of time. The SAIO will be utilised to make even ridges. A trial will be done to see if more than one ridge can be made at the same time in order to maximise on the effectiveness of the machine.
3. **Planting of bulbs for Saffron cultivation**: the planting of bulbs in an organised manner, i.e. with the bulbs planted in the most *economic* manner, is a major issue.

Manual planting is often - in practice - a rather imperfect operation conducted by semi-skilled or almost unskilled workers. Instructions how to plant and specific instructions with regard to the distance between bulbs are often not strictly followed.

This translates into an uneven division of planted material over the entire area where Saffron is cultivated or Crocus sativus bulbs are grown.

Land is in principle a scarce commodity. The Saffron yield in New Zealand and some other areas has increased to 15 kgs per Hectare (10,000 m2). With 600,000 bulbs planted - while evenly divided - per Hectare, and with proper soil and crop management, provided the weather conditions are favourable, such yields can be achieved during 2-3 years of 4 year crop cycles. This would make Saffron cultivation a much more viable option, also in traditional Saffron cultivation areas.

The **SAIO Prototype I** will have to be tested to see whether even planting, in combination with ridge creation, will be feasible and working out well. On the basis of the test results, further fine-tuning can take place in Phase II.

4. **Harvesting of Saffron flowers**: the harvesting of Saffron flowers, even though this is concentrated and restricted to a period of approximately 10-14 days per year, during the period end of October - beginning of November, is a very labour intensive and truly tough job. The harvesters need to get up early and start plucking the flowers that have opened each single day. In traditional Saffron producing areas as well as in newly developed areas, it has become increasingly difficult to find workers who are willing and able to do this job.

   The **SAIO Prototype I** will be tested to see whether the harvest of Saffron flowers can be mechanised without the loss of a substantial percentage of flowers.

5. **Removal of weeds**: during crop management cycles throughout the year, the removal of weeds is a continuous source of concern. Outside the harvest season end of October/beginning of November, the Saffron cultivation is almost continuously labour extensive. This means that basically a small rump staff is kept to manage the crop.

   As weed control is a tedious job, the discipline among workers is often far from optimal. Therefore, weeds compete for space and nutrients as well as water with the cultivated crop. This situation is undesirable.

   The **SAIO Prototype I** is equipped with a function that will remove weeds from around the area where the Crocus sativus bulbs are planted. The removal of weeds can take place during a major part of the year, when the Crocus sativus bulbs are dormant and there is no leaf growth above soil level. This function of the **SAIO** would be very beneficial for the development of the Saffron crop during the growing stages as well as for the development of new bulb material.

   The actual effectiveness of this function of the **SAIO Prototype I** will be tested repeatedly during trials in the coming months.

The outcome of the tests and the further development of the **SAIO** will be described in the following report that can be expected within approximately 10-12 months, after the harvest season in 2017.

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