

What research and steps have been taken in regard to *Jatropha curcas* L becoming an intricate part of sustainable biofuels?

Domestication and breeding of JCL

A huge segment of the world's economy is presently based on non-sustainable fossil fuels. Therefore, the challenge is to move into an economy based on sustainable fuels that secures the environment and resources of the next generations.

Within this context, *Jatropha curcas* L (JCL) will play an important role as the plant has a large potential to produce high quality oil that can be used as feedstock to produce sustainable biofuels.

The main limitation to grow JCL on a large-scale however is the lack of improved cultivars and proved agronomic management knowledge. Therefore, domestication and breeding is crucial to transform the potential of JCL into a real economic solution to the sustainable fuel question.

Potential

JCL presents the highest genetic diversity in germplasm originated from Central

and North America (CNAM) where, quite possibly, it originated from. Low genetic variations have been observed in germplasm originating from Asia, Africa and South America.

A hypothesis explaining this distinct pattern of genetic variation between CNAM and other regions is that the seeds, or clonal material of a few individuals, might have been transported during colonial times to regions in Africa, Asia and South America and, therefore, the genetic base of the germplasm from those regions is narrow.

The loss of genetic diversity in those regions might have also been fostered by the fact that locals used to multiply JCL clonally by cuttings which might have increased the rate of inbreeding within those populations.

The potential yearly oil production per hectare of JCL is large. By using the right combination of genetics, growing location and agronomic management,

JCL would rank second, after oil palm, in the list of oil producing plants. In addition, JCL can be grown in a wider area than oil palm due to its large adaptation capacity.

Compared to annual crops, cultivation of perennial ones like JCL has the advantage that sowing and planting costs only arise in the first year of production. Perennial crops are of particular importance in regions with uncertain rainfall patterns.

Annual crops such as maize or soyabean are detrimentally affected or lost completely during droughts, while JCL will stop production during the dry period and start again once water becomes available. There is no need to invest into sowing and planting again, a well appreciated characteristic by the growers.

Putting into practice

The failure of several JCL projects in the past should not have been too much of a surprise

because neither superior cultivars, nor professional agronomic know how, were available at the time.

JatroSelect, a subsidiary of energy consultants JatroSolutions that works with JCL, believes it now has the knowledge needed to guarantee sustainable economic production of JCL. It has a network of field experiments which cover a large gradient of climates, soil types and economic systems, allowing it to identify the right combination of genetics, growing location and agronomic management to optimise JCL production.

Its breeding programme is based on its own infrastructure in Cameroon and Paraguay and strategic alliances in India and Madagascar. There is a main breeding station within each country and several satellite locations for testing purposes. It also works in cooperation with universities and has a well-established network with the University of Hohenheim.



Unsafe: the jatropha in this picture is toxic



Safe: the jatropha in this picture is non-toxic

The breeding programme has three technical components: germplasm, phenotypic characterisation and genetic characterisation. The germplasm refers to the genetic material (seeds, seedlings, cuttings) available to the breeder. It is crucial that the genetic variation available in the germplasm contains the variation of important economic traits that the breeders want to use.

The phenotypic characterisation refers to the assessment of the germplasm's expression on matters like oil yield, flowering pattern, plant architecture, plant health, toxicity and other traits.

The genetic characterisation of the germplasm refers to the molecular analysis at DNA level. The breeding strategy is then defined by the breeders in order to optimise the breeding progress, making the best use

of the available germplasm and breeding information.

The JatroSelect programme has progressed continuously over the last four years. It has made investments into the systematic worldwide collection and documentation of the germplasm. It has also characterised germplasm for oil yield, seed quality, resistance and tolerance to biotic and abiotic factors across a wide range of environmental conditions.

Presently, the project is generating superior cultivar seeds to be released next year and it will test generated experimental hybrids this year. It expects to release the first superior cultivar in the second half of 2014.

Breeding objectives

The first is to increase oil yield and stability across environments and years. The

second objective is to improve seed quality, like increasing oil content while eliminating phorbol ester, a toxic chemical compound that limits the use of the pressed cake leftover for animal feed, for example. A third objective would see a reduction in production costs, like improving plant health to reduce control measure costs as one example.

The cultivars will be commercialised throughout production through uptake agreements with selected clients, based on their business volume and scope.

But, in respect to JatroSelect's future expectations, it believes it will certainly see an increment in the total area planted with JCL in years to come. There could be two production systems: one based on small growers, up to one hectare, with low or no mechanisation and another based on large

growers, who have over 1,000 hectares, with a high level of mechanisation, with some in between those two points.

But, in all cases, the logistics of production and processing will play a significant role towards the economic end result. In any case, a complete project concept, from production to market is needed before starting business with JCL. ●

For more information:

This article was taken from an interview with Juan M. Montes, breeding director at JatroSelect. office@jatroselect.com

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