

Better stubble beats drought

The hardiest crop for the toughest conditions – researchers are working to boost livestock production from pearl millet straw, reports Fiona Conroy

PARTNER COUNTRY: India **PROJECT:** LPS/1999/062: Improving the quality of pearl millet residues for livestock
DESCRIPTION: Researchers are working together to improve livestock production by improving pearl millet's feed qualities
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The thrust of modern plant breeding to increase crops' grain yields has often overlooked the importance that crop residues play as a source of livestock feed. Yet in dry, arid agricultural areas it is vital nothing is wasted. When grain crops are harvested, the straw left behind is a potential source of feed for sheep, goats, camels, buffaloes and cattle.

Developing new hybrid varieties of pearl millet – the most widely grown millet – that have good grain yields and offer better quality straw for livestock is the goal of a major ACIAR-funded project.

The project brings together plant breeders from the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) in India, livestock nutritionists from the International Livestock Research Institute (ILRI) in Nairobi, national program pearl millet breeders in India and both public and private Indian seed companies.

Millet is any of about a dozen small-seeded grasses that are harvested as grain crops and pearl millet is the fifth most important cereal crop globally (after rice, maize, wheat and barley).

It is grown in more than 40 countries, from southern and western Africa through to India and Myanmar in southern Asia. It is used as a staple food grain and source of feed, fodder, fuel and construction material.

India is the largest producer of pearl millet, both in terms of area (9.1 million hectares) and annual grain production (7.3 million tonnes). India's average crop produces per hectare about 800 kilograms of grain as well as a couple of tonnes of straw, says Dr Tom Hash, the pearl millet breeder leading the project from ICRISAT's headquarters in Patancheru, Andhra Pradesh, India.

"In agricultural terms, pearl millet is the dual-purpose grain and straw crop of last resort in the driest regions of the tropics and subtropics – it can grow in areas where other crops are not an option," he says. "It can cope with extreme conditions which include high temperatures, low soil fertility and minimum rainfall."

Dr Hash says farmers in the desert margins of the north-western frontier states of Gujarat, Rajasthan and Haryana in India, near the border with Pakistan, are expected to benefit from this project.

Pearl millet covers nearly seven million hectares in this region, which is home to about 60 million people and includes the most heavily populated

desert in the world.

Farmers sow their crops when the rains arrive in late June or early July and then harvest from September to October, Dr Hash says. "Pearl millet allows them to harvest a grain crop just 65 to 85 days after sowing, often with less than 400 millimetres of rain during the growing season."

Pearl millet growers in this region are mostly small, subsistence farmers who sow less than five hectares of the crop a year. Grain harvested is principally used for their own household consumption, with the main source of farm income coming from livestock and milk sales, making better quality feed stock important.

Pearl millet straw is harvested in bundles and stored to use as stock feed, but the challenge for Indian farmers is dealing with its poor feed quality – it has a digestibility of 40 to 45 per cent. The straw is often chopped and fed to livestock during the dry season as a maintenance ration to help slow their rate of weight loss. Dr Hash says pearl millet straw is not a great feed for livestock. "But it is produced locally and supplements the limited available grazing resources.

"When we've surveyed farmers, they've repeatedly identified livestock fodder as a high priority because it's the cash income from livestock that pays for items such as hybrid seed and school fees. Improving the yield and feed quality of the pearl millet straw will have a major impact on these people.

"Our economic modelling shows that by improving the digestibility of the straw by one per cent, and then having the improved varieties adopted by just 10 per cent of the farmers, economic returns to farmers in the region would increase by an estimated US\$10 million a year."

Farmers growing pearl millet in India already recognise the benefits of buying and sowing hybrid varieties for increased grain yields. About 70 per cent of the pearl millet grown in India is sown to commercial hybrid cultivars, most of which were developed from ICRISAT parental lines.

Researchers are now looking at using con-



New varieties of pearl millet with good grain yields and better quality straw are the goal of a major new ACIAR-funded project.

ventional and biotechnology-assisted plant-breeding techniques to improve the quality of the pearl millet straw in

the parental lines used to produce

these commercial hybrid cultivars.

The project, which began two years ago, has investigated naturally occurring variation in the crop and is using gene-mapping tools to identify the portions of pearl millet's genetic material that control traits related to straw quality and yield.

Three pearl millet genetic regions have been identified that together have the potential to improve overall straw digestibility by up to five per cent – well above the one per cent increase used in the economic modelling.

The more favourable natural variants identified in these genetic regions are then incorporated into the elite parent lines of popular pearl millet hybrids using plant breeding techniques such as backcrossing.

"We have to make sure the plants we breed are going to better meet the needs of the farmers," Dr Hash says. "Pearl millet is a dual-purpose crop, so we have to make sure we don't compromise grain yields while breeding for increased straw yield and quality.

"So far we've found suggestions of an association between drought tolerance and improved straw quality, which is an added bonus."

Field trials of hybrids produced with the first new lines begin this year and will continue over the next three years as new parental lines with improved straw quality are developed.

The researchers are also working with private and public sector pearl millet breeders in India to trial new hybrids involving the improved parent lines, with the aim of making these hybrids commercially available.