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Development of new, high yielding tropical grass varieties for increasing productivity of semi-arid grasslands in India

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Introduction

Indian agriculture has traditionally been a mixed farming system since ancient times with integration of arable crops and livestock. It provides employment and livelihood to 70% of the rural population. Livestock are predominantly cattle and small ruminants that graze extensively on rangelands/pasturelands and common property resources (CPRs). CPRs occupy approximately 54 million ha area including permanent pastures in the alpine and temperate parts as well as seasonal grazing lands and wastelands. The productivity and carrying capacity of tropical degraded grasslands is very low, the average carrying capacity being 1.0, 0.7, 0.7 Adult Cattle Unit (ACU)/ha in semi-arid, arid and hill areas respectively. One of the options to increase livestock productivity is to grow more pasture by introducing higher yielding tropical grass varieties. *Sehima nervosum*, *Heteropogon contortus* and *Chrysopogon fulvus* are major species components of semi-arid tropical grasslands. These perennial grasses dominate two of the five major grassland covers, *viz. Sehima-Dichanthium* cover and *Dichanthium-Lasiurus-Cenchrus* cover.

Methods

A wide diversity of tropical, perennial grass germplasm from the Gramineae/Poaceae family was collected through systematic plant collections from different parts of India. The germplasm was tested in multi-location trials throughout India under evaluation protocols established by the All India Coordinated Research Project on Forage Crops. The material was grown for four years in an ungrazed trial system. Nitrogen (N) fertilizer (applied as Urea) was used at various sites as per local agronomic practices. The green above-ground biomass was assessed by cutting at a height of 15 cm, several times a year. Data included green forage yield (GFY), dry matter yield (DMY), acid detergent fibre (ADF), neutral detergent fibre (NDF) and crude protein (CP) content. The quality parameters were recorded at the time of 50% flowering. The plants (both stem and leaves) were harvested 15-20 cm above ground level, dried in oven and ground, sieved, analysed. Better genotypes in terms of biomass yield, tolerance to insect-pests and nutritional quality parameters were selected. Three such varieties are described below.

Results and Discussion

Chrysopogon fulvus variety Bundel Dhawalu Ghas 1

Chrysopogon fulvus commonly known as 'Dhawalu Ghas' in Hindi vernacular is dominant across the whole of the Indian peninsular in rainfall zones from 250 to 800 mm. The variety Bundel Dhawalu Ghas 1 (IGC 9903) was developed following introduction and selection from accession IG 2014B collected from western India. It is a high yielding forage variety with improved nutritional quality and tolerance to major pests especially defoliators and diseases. Under rainfed conditions it produced approximately 30-35 t/ha of GFY and 7-8 t/ha of DMY per annum with 8% CP, ADF 46% and NDF 76% on a dry matter basis. It has multi-cut tolerance and tussock height normally goes up to 100-120 cm depending upon cutting frequency. It is moderately palatable, has medium green foliage and is erect and multi-tillering. The variety is responsive to nitrogen fertilizer. The variety is released for use in the various states of India, *viz.* Central Madhya Pradesh, southern part of Uttar Pradesh, north Karnataka, Rajasthan, Rayalseema region of Andhra Pradesh and south of Maharashtra. The variety can be used by directly grazing sown pastures or by a cut and carry system of management.

Heteropogon contortus variety Bundel Lampa

Heteropogon contortus is commonly known as 'black spear grass' or 'Lampa ghas' in local Hindi vernacular. It is an erect perennial, high tillering, multi-cut grass which survives for 6-8 years in tussock form and propagates in nature by seed. It is an apomictic grass with facultative sexual reproduction in some of the accessions. The variety Bundel Lampa 1 (IGHC 03-4) was developed following introduction and selection from accession IG 95-284, collected from the Datia district, Madhya Pradesh, India. The tussock height goes up to 70-100 cm depending on cutting frequency or grazing intensity. The variety is very palatable and suitable for grazing at the vegetative stage. However, due to the presence of long awns, cattle do not graze it during the late flowering stage. The variety is tolerant to major insect pests (particularly defoliators) and diseases (mainly anthracnose and blight). The productivity is 30-40 t/ha GFY and 8-9 t/ha DMY per annum. It has good quality with approximately 6.6% CP content on a dry matter basis

and average ADF and NDF being approximately 45% and 72% respectively. The variety is highly suitable for rangeland and community grazing land in drought prone areas. It is suitable for use in rangeland situations of semi arid, tropical and sub tropical areas during the monsoon season from July to November under rainfed conditions.

Sehima nervosum variety Bundel Sen Ghas 1

Sehima nervosum is an erect, highly tillering, perennial grass, commonly known as Sen Grass or 'Sain Ghas' in local Hindi vernacular. The variety Bundel Sen Ghas 1 (IGS 9901) was developed following introduction and selection from accession IG 2045 collected from western India. It is a high yielding forage variety with yields up to 30-40 t/ha GFY and 8-9 t/ha DMY per annum under rainfed conditions. The tussock height goes up to 55-80 cm depending on cutting frequency or grazing intensity. It is tolerant to major insect-pests (particularly defoliators) and diseases. It has high quality with CP content approximately 6.8% on dry matter basis and average ADF and NDF being 54% and 72% respectively. The variety is recommended for states like central Madhya Pradesh, southern part of Uttar Pradesh, north Karnataka, Rajasthan, Rayalseema region of Andhra Pradesh and south of Maharashtra where there are large areas of grassland. Being a rangeland perennial grass it is highly suitable for poor farmers and for community grazing lands, especially in drought prone areas.

Method of cultivation

All varieties are apomictic and can be raised by both direct sowing of seed or by transplanting seedlings, though transplanting is preferred. For direct sowing seed pellets should be prepared by mixing the seeds with moist clay or soil as seeds are very light in weight. For seedling transplants, a clear and well prepared seed bed is necessary to raise the seedlings. The nursery bed should be ready by mid- June and located in areas where irrigation is available. Six week old seedlings from the nursery bed are transplanted generally in July after the first heavy rains. Recommended spacing is; between rows 50 cm, between plants 40 cm. This would mean that 100,000 grass seedlings per hectare are required with two seedlings planted at each spot. Inter-row weeding should be done twice during the growing season. For land preparation, the area should be cleared of bushes and other vegetation. With the onset of the monsoon, the land should be prepared by ploughing. At first a basal application of 10 cartload of Farm Yard Manure is required. This is followed by basal application of 20 kg N/ha and 20 kg phosphorus (P_2O_5)/ha. One month after establishment another 20 kg N/ha is topdressed between the grass rows. In subsequent years 20 kg N/ha and 20 kg P_2O_5/ha are broadcast across the grassland with the first rains.

In the year of establishment only one cutting is done in mid-October. In subsequent years, two to three cuttings can be taken, first after 60 days growth and then at 30 to 45 day intervals, depending upon the pattern of rainfall distribution. One more cutting is possible during the growing season in March or April. The cutting height should be 10 cm from ground level. For effective seed collection, the last cut should be sacrificed. For all varieties, flowering starts at the end of the monsoon i.e. month of October and seeds generally mature in November in the Indian peninsular and 15-20 days later in southern India depending on rainfall distribution.

Farmers can purchase seeds from private seed growers or sometimes they are provided free of cost under various government developmental schemes.