Yield Potential of Co_4 Napier Hybrid Bajra (Pennisetum perpureum Schumach.) Fodder Crop Under Irrigated Conditions in India

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Abstract : A field trial on Co_4 was conducted at ICAR-IVRI, Izatnagar during 2013-14 to 2017-18 to study the effect of harvesting season/time on green, dry matter yield and morphological parameters. Data shows that yield of Co_4 was increased from first year 2013-14 to third year 2015-16 and decreased in fourth year of plantation of crop. Re-growth of ratoon crop was good as it was in first year crop, it may be concluded that crop can be grown upto 5-6 years. The crop yield of first year and second year as par with fifth year. Maximum green fodder yield 307.7 q/ha in 2015-16. In 5th year (2017-18), ratooning yield was at par 301.3 q/ha with 2nd to 4th year (2014-15 to 2016-17). Good package of practices are recommended for ratooning to get good yield as well as economic production for long time 5-6 years of ratooning. The crop Co4 produced maximum green fodder yield (307.7 q/ha) in Aug-Sep.

Keywords : Napier Hybrid, Nutrients, Ratoon Crop, Livestock, Elephant Grass

Introduction Napier grass (Pennisetum purpureum Schumach.) is a fast growing perennial grass native to Sub-Saharan Africa that is widely grown across the tropical and subtropical regions of the world. It is a multipurpose forage crop, primarily used to feed cattle in cut and carry feeding systems. Characterization and diversity studies on a Napier grasses have identified a moderate level of genetic variation and high lighted effect of agronomic practices on phenotopic charactor of crop. In India napier bajra hybrid variety development was intiated in late eighties at PAU, Ludhiana, Punjab, India. A very popular variety NB- 21 was developded from exotic elephant grass from Africa.

Sustainable livestock production is highly dependent on the availability of quality feed and forage resources. Napier grass, also known as elephant is one of the most important tropical forage crop. It is widely used in cut and carry feeding systems. and is of growing importance in other agricultural systems. Napier grass possesses many desirable characteristics, including high yield per unit area, tolerance to intermittent drought and high water use efficiency, making it a forage of choice. It has the ability to withstand repeated cutting and will rapidly regenerate, producing palatable leafy shoots. Consequently, enhancing the knowledge-based use and conservation of the available Napier grass resources to sustain the livestock sector in India.

Elephant grass, as implied by its name, is important source of forage for elephants in Africa, Elephant grass is a morphologically leafy and high tillering plant. Hybrid Napier Co_4 grass is one of the widely cultivated fodder grass because of its high nutritive value. This grass is an inter specific hybrid between elephant grass and bajra grass. Compared to other fodder crops hybrid. This grass is called as “King of Napier grass”. Super Napier grass is best suited to higher rainfall areas, but it is drought-tolerant and can also grow well in dry areas. It does not grow well in waterlogged areas. Hybrid Napier is a annual plant but plant can be cultivated as ratoon crop /grass which needs to be retained in the field for more years to reduce crop cultivation costs. Compared to Napier grass, Hybrid napier produces larger and softer leaves. Its ease of regeneration and high productivity make it perfect for the feeding of cattle, and grazing of small animals in the pasture land.

Materials and Methods :

A field trial was conducted on one acre of land of fodder form of ICAR-IVRI, Izatnagar, Bareilly (UP), India during 2013-14 – 2017-18. The crop Co_4 was planted in rows 60 x 60 and plant to plant 50 x 50 cm. Soils were sandy loam, medium in N, P and K availability and pH 7.2, water holding capacity, soil structure, soil texture and organic matter content were in medium range. Harvesting of crop was schedulted at 60 days. As T1- April-May (Spring), T2–June-July (Summer), T3- August-September (Rainy), T4-Oct-November, T5-December–January-February-March (Lean Period /Winter Season).

Data were collected under RBD with three replications. Samples were analysed for yield, dry matter and morphological parameters. All recommended agronomic practices such as manure and fertilizer applications, weed management, plant protection including irrigation at moisture deficit were maitained. Organic manure 5t ha-1 was applied at the time of field preparation. Fertilizer doses were maintained in every year.

Results and Discussion :

The data shows that the morphological response, green forage and dry matter, yield were significantly influenced with the year of cultivation and season/months of harvesting.

Effect on Morphological Parameters : The plant height, leaf length, leaf width, number of lears per clump and number of tillers per clump are contributing traits to forage biomass and were found to be affected significantly during the time of harvest. Harvesting during July-August-Sep these traits were found to be increased significantly as compare to harvesting carried out during December-January-February months. Availabilty of rains/ moisture and long days hours, high temperature might influenced the plant physiology, higher photosynthates accumulation, better availability of moisture in root zone and reduction in abiotic plant stress conditions, alongwith sufficient availability of plant nutrients near root tips might be the reason to produce the significantly higher measures of the above traits.

Table 1 : Forage yield qha^{-1} of Co$_4$ as influenced by harvesting time and ratooning/ year

Treatment	2013-14	2014-15	2015-16	2016-17	2017-18
Apr-May	233.1	212.5	214.4	199.4	183.5
Jun-Jul	271.3	280.1	296.3	227.6	198.4
Aug-Sep	280.4	301.6	308.7	268.6	301.3
Oct-Nov	216.6	285.7	289.4	176.3	177.6
Dec-Feb-Mar	103.2	176.4	113.6	114.5	105.4
CD at 0.5%	7.12	11.34	9.84	7.19	6.48

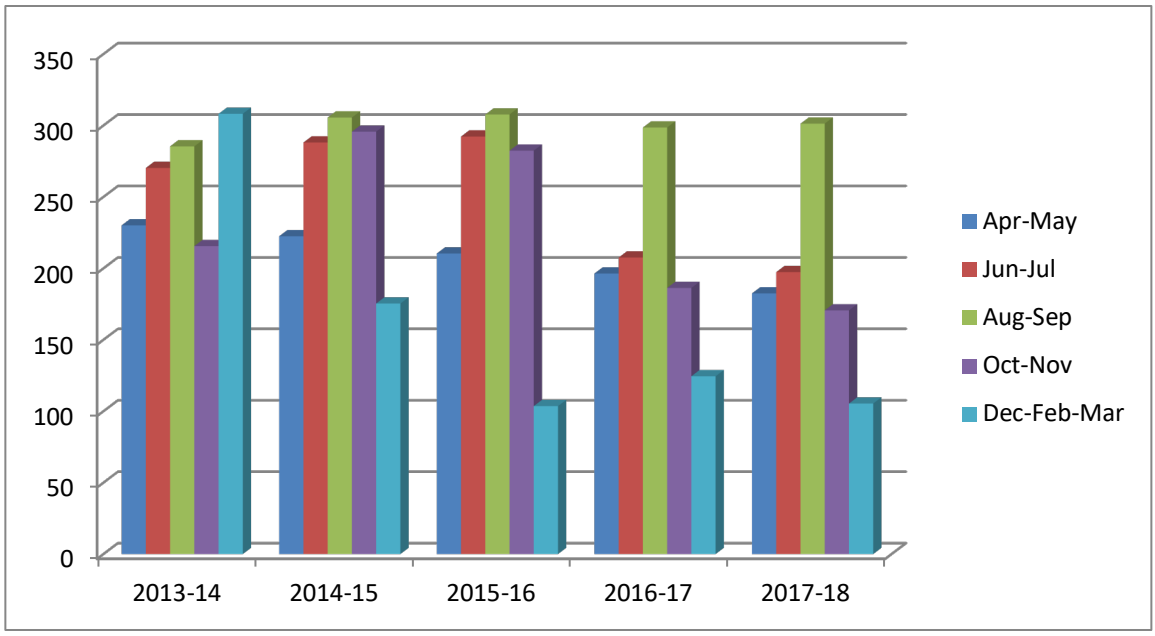

Fig.1: Forage yield (q/ha) of Co4 as influenced by harvesting time, rtoon/year

While, during the December-January-February due to low temperature (minimum and maximum) and short days hours in the Rohilkhand region, northen India increased plant stress on Co_4 BN crop and enhanced reduction in traits performance.

Effect on Forage yield: Forage yield was recorded higher while crop was harvested in summer and rainy season (301.3 q/ha) as compared to winter months (105.4 q/ha). This period may be called as lean period for forage production of Co4. This significantly reduction is yield might be due to favourable and unfavourable conditions to the plant. Co4 is tropical climate loving plant but in Rohilkhand Region, northern states of India falls under the sub-tropical climatic conditions and low temperature (minimum – below 10^0C and maximum below 20^0C) in December, January, February where as plant growth was found to be dorment. Hence, harvesting is suitable in last week of March month. During this winter period of short duration inter crop like Barley, Berseem, Mustard or Pea can be recommended to boost the ratoon crop yield from December to February. This practiced may increase Co4 forage yield and quality of forage (leguminous-Barley/lucerne).This may not be the brolem in southern states of India.

Table 2 : Morphological Parameters of Co_4 at harvesting time/year

Treatment	Plant height (cm)	No. of leaves per clump	No. of tillers per clump	Stem leaf ratio	Leaf length (cm)	Leaf width (cm)
Apr-May	51.4	94.6	16.1	0.71	71.6	3.0
June-July	54.3	105.3	23.3	0.72	93.3	3.6
Aug-Sep	57.1	101.1	28.2	0.80	99.4	4.4
Oct-Nov	43.5	100.6	30.2	0.82	101.7	4.3
Dec-Mar	31.7	87.7	29.3	0.95	89.6	3.2
CD at 0.5%	0.22	2.24	3.16	0.11	4.03	0.87

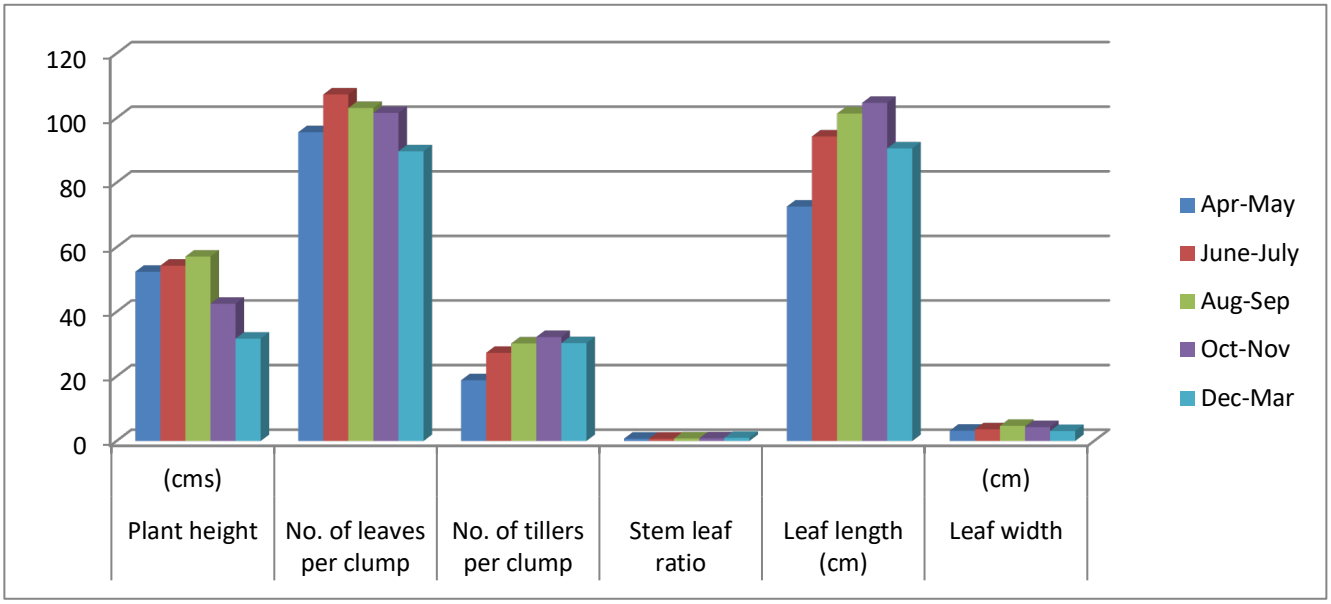

Fig.2: Morphological parameters of Co4 NHB crop at harvesting time/year

Effect of Nutrient management and Ratooning/regeneration : Yield of crop was increased upto three years from 2013-14 to 2015-16 and found to be stable during next two years from 2016-17 to 2017-18. The nutrition of crop is important besides NPK application of Bio-manures, FYM, Vermi-compost, Bio-fertilizers, or Organic manure. Mixing of manure between rows is necessary to maintain regrow with and yield of 5

years ratoon crop. To control weeds in rows after rainy season sowing of inter crop like mustard, berseem, Barley is recommended. This crop may be incorporated in February-March by Weeder mannual / Tractor tillers were used for inter culture of crop for weeding , which increased organic matter in the soil and availability of nutrients. Pea, Mustard, Menthi, or Palak/ Spinach crop residues may also improve the soil structure and fertility status. Under trial Berseem was found to be better inter crop over the Annual Rye Grass and Barley ,where these crops were sown in November to February in betbeen of rows to control the weeds. This inter spacing may be used for alfalfa crop during December to April.

Table-3 : Dry matter yield of Co4 NBH as influenced by harvesting time (years)

Treatment	2013-14	2014-15	2015-16	2016-17	2017-18
Apr-May	64.3	79.3	71.3	69.1	65.2
Jun-Jul	76.1	81.0	82.4	78.3	76.2
Aug-Sept	78.1	83.3	82.6	82.1	79.5
Oct-Nov	72.5	76.3	80.6	76.5	73.1
Dec- Mar	59.2	66.2	67.4	65.2	61.5
CD at 0.05%	3.15	4.36	3.31	5.22	3.12

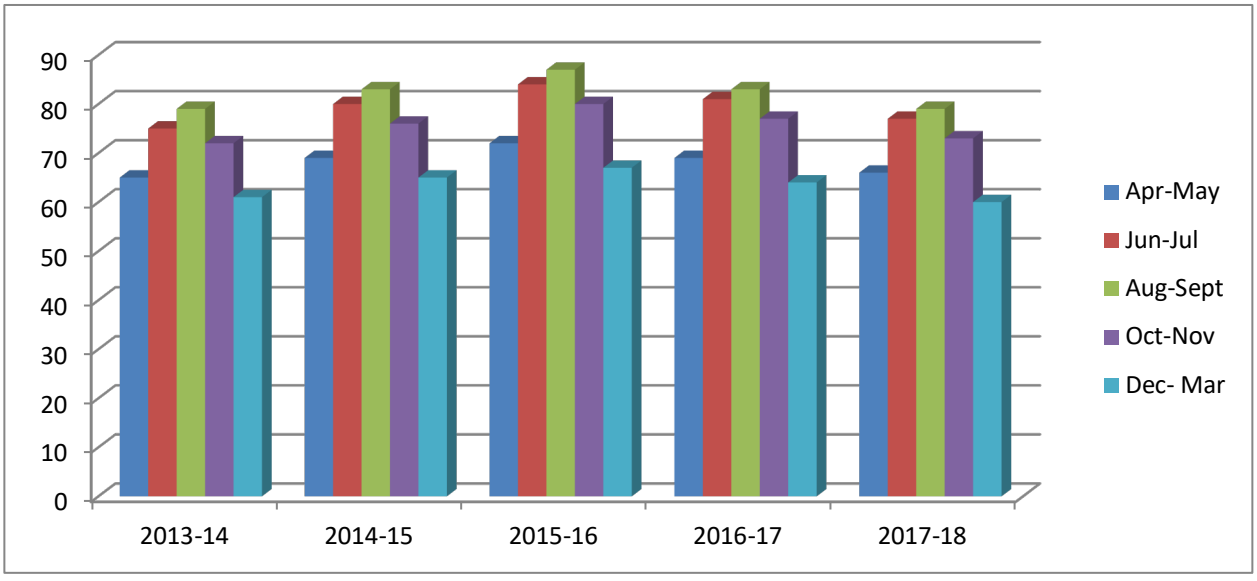

Fig.3: Dry matter yield of Co4 NBH crop as inluenced by harvesting time/year

Effect of irrigation on Ratoon Crop of Co_4 : Co $_4$was found better when soil mixture was maintained throughout the year. Sufficient water in rest zone provided abiotic stress free environment. To produce ratoons of Co_4 for five years after harvest every month irrigation of fields is important. It was found that where irrigation was delayed or crop nutrition was not applied at proper time of the growth and yield was reduced.

Effect of weed management : During five years of crop ratooning it was found that clumps of crop were increased every year. Number of tillers per clump were recorded maximum in 2017-18. To maintain yield potential, it is recommended that every year plants become thinner than the first year of plantation. Therefore, proper weeding inter culture of crop, maintainance and proper irrigation are necessary. Weeds competition with crop and reduced the re-growth of new tillers.

Effects of Harvesting on yield and forage quality : Harvesting at right time is important. If harvesting is delayed for few weeks than every week crop become harder, unpalatable and increase in dry matter content in plant. Soft leaves and succulent stems are essential to increase digestibility and feed intake by animal. During rainy season crop growth was very faster than winter and summer season. Delayed harvested or more than 75 days after previous cut ,the crop found to be high in dry matter and undigestible content like lignin. During summer April-May-June crop shows ear head appearance. Reproductive stage/seed formation stage is a sign of physiological maturity of crop. Therefore, roots with balanced nutrition, irrigation, weed free conditions are pre requisite of ratoon crop for five years of cultivation. Cutting with proper equipment or mannual or mechanical method is necessary alongwith proper height of plant at harvest, at right time of harvesting as well as proper watering and fertilizer application after every harvest found to be economic.

Conclusion : Data shows that yield and quality of forage of Co_4 was affected by several factors like harvesting time, harvesting year, integrated nutrient and weed management,

alongwith maintenance of regime of water in root zone as per the season ,especially during March-April-May and June before rainy season and post rainy season like october-November too. Plant is fast growing and needs frequent nutrition and water application. Without proper adoption of agronomic practices crop may not sustain for five years. Because uptake of nutrients and water found to be higher due to higher biomass (1500 q /ha/year) production. The NHB Co4 was superior over the other multicut crops. Hence, crop with good package of practices can be grown upto 5th years as a ratooning of Co4 Napier Hybrid.

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