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Effect of deproteinised leaf juice (DPJ) of gulmohar on growth of jowar

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Abstract
This research examines the effect of deproteinised juice on the growth parameters of Jowar (*Sorghum bicolor* L.), commonly known as jowar. The objective of this study was to evaluate the potential effects of deproteinised juice on vegetative growth and overall development of sorghum plants.
The process of deproteinisation involves the removal or reduction of protein from juice, and its effect on plant growth through possible changes in nutrient availability and other physiological factors is a topic of interest. In this experiment, deproteinised juice of *Delonix regia* (Bojer ex Hook.) is used to study the apparent difference in the growth pattern of sorghum.
The experimental design includes various growth parameters, such as plant height, leaf area, and chlorophyll content. The nutrient content of the deproteinised juice is analysed to clear up any relationship between nutrient availability and observed plant responses.
Preliminary results indicate that deproteinised juice may have a notable effect on the early growth stage of sorghum. However, a comprehensive data analysis is required to draw conclusive insights into the effects on overall plant development. Understanding these results is important for evaluating the viability and potential advantages or disadvantages of using deproteinised juice in agricultural practices, particularly for sorghum cultivation.
This study contributes valuable insights to the intersection of plant physiology and food processing, highlighting the potential effects of deproteinised juice on growth parameters of a major cereal crop. Further research in this area can inform sustainable agricultural practices and increase our understanding of the complex relationship between plant development and processed food by-products.

Keywords: Deproteinised juice, sorghum, *Delonix regia* (Bojer ex Hook.), chlorophyll

Introduction

The research paper presents the Green Crop Fractionation process as an innovative solution to address global challenges such as climate change and depletion of agricultural resources. The process involves separating and using different components of crops, creating a closed-loop system to sustainably produce high-value products. Prof. Pirie (1942) [10] determined the process of Green Crop Fractionation (GCF). This paper aims to explore the principles, mechanisms and applications of Green Crop Fractionation, emphasizing its potential to shape agriculture by promoting environmental sustainability and economic viability. Discussions will include case studies to demonstrate environmental benefits, economic feasibility and real-world applications, emphasizing the transformative impact of green crop fractionation on agriculture.

The paper envisions this process as a paradigm shift towards a more sustainable and regenerative future, contributing to the reduction of the carbon footprint and environmental degradation associated with traditional agricultural practices. Subsequent sections will explore the fundamental aspects, technological advancements, environmental impacts, economic feasibility and the role of green crop diversification in promoting a circular economy. The aim is to provide a comprehensive understanding of its potential as a catalyst for sustainable agricultural development.

Prof. Pirie (1942) [10] determined the process of Green Crop Fractionation (GCF). The process of GCF involves extraction of protein from green leaves for use as nutritional purposes in human and animals. The process of Green Crop Fractionation (GCF) has been recommended for preparing high quality food grade product from leaves (Pirie, 1971). During GCF, leaf juice is extracted and heated to 90 °C, as a result of which proteins in it coagulate to form leaf protein concentrate (LPC). The LPC is isolated from remaining portion of leaf juice, called as deproteinised juice (DPJ), by filtration through cotton cloth. The use of LPC as a protein and vitamin A supplement in human and animal nutrition is well recommended while the DPJ is considered as a byproduct of this process (Pirie 1987; Sayyed and Badar 2010) [11, 13].

The DPJ is a by-product of GCF system, which is produced in large volume. This brown juice is also known as "whey" or "daru". (Jadhav 1997; 2015; Patil and Wadje 2011) [3, 5, 8].

As we all know, DPJ contains sugar, amino acids, vitamins and other biological substances. Distribution of the calcium, phosphorus and nitrogen content in DPJ and other byproducts was investigated in GCF (Igor *et al.*, 2007; Jadhav, 2014) [2]. (Kummerlin, 1984) [6] obtained good yields of Candida utils on DPJ from 10 plant species. In the pharmaceutical industry, bioactive compounds from DPJ can be investigated for their medicinal properties, counting antioxidant, anti-inflammatory and antimicrobial effects (Surbhi *et al.*, 2023) [14]. DPJ has promise in nutrition, medicine and agriculture (Mungikar., 1986) [7]. In the context of global sustainability challenges, the importance of DPJ as a sustainable source cannot be ignored (Casselman *et al.*, 1965) [1].

Materials and methods

1. Preparation of DPJ

For this work green foliage from *Delonix regia* (Bojer ex Hook.) plant is selected to prepare deproteinized leaf juice. In leaf protein extraction, the fresh material is mechanically pressed so that the leaf protein is released into the pressed plant juice. Followed by protein precipitation and Heat coagulation. The juice from the pressed leaves is then heated to boil, resulting in the protein in the juice being coagulated into a curd known as LPC. After separation of LPC from the heated juice, deproteinized leaf juice (DPJ) is released as a product.

2. Nutritional components found in DPJ

DPJ of Jowar (*Sorghum bicolour* L.) contain a variety of biochemical compounds that play an important role in their growth and development. The Biochemicals found in DPJ are Nitrogen, Carbohydrate, Phosphorus, Calcium, Ash, Crude fibre, Crude extract (Crude fat) etc. Nitrogen is an essential element for plant growth, development and overall health, Carbohydrates play an important role in energy storage and transfer, structural support, regulation of osmotic balance, and various physiological processes required for growth and development.

Phosphorus plays an important role in energy transfer, nucleic acid synthesis, cellular structure, enzyme activation and various metabolic processes. Adequate availability of phosphorus is important for plant health and crop yield. Calcium is a macronutrient that plays an important role in cell wall formation, cell division and other structural functions. It is important for plant growth and development, especially for the formation of strong cell walls. Table 1 shows the Analysis of nutritional components found in DPJ.

Table 1: Analysis of nutritional components found in DPJ of *Sorghum bicolor* L. plant

Sr. No	Name of Analyte	Result	Unit	Instrument	Test method
1.	Nitrogen	3.24	%	Microkjeldahl's Apparatus	IS: 7874 (Part-I) 1975 RA 2014
2.	Ether extract (Crude fat)	1.76	%	Soxhlet's ether extraction apparatus	IS: 7874 (Part-I) 1975 RA 2014
3.	Total Ash	4.23	%	Muffle furnance	IS: 7874 (Part-I) 1975 RA 2014
4.	Crude fiber	3.11	%	Fibertherm	IS: 7874 (Part-I) 1975 RA 2014
5.	Calcium	3.69	g/kg	-	IS: 7874 (Part-II) 1975 RA 2014
6.	Phosphorus	2.87	g/kg	-	IS: 7874 (Part-I) 1975 RA 2014
7.	Carbohydrate	87.66	%	By Calculation	-
8.	Energy	379.44	Kcal	By Calculation	-

3. Application of DPJ

After 7 days of seedling growth, DPJ is initially applied. Subsequently, DPJ is reapplied at 5-day intervals to the soil in the Jowar (***Sorghum bicolor*** L.) crop

4. Estimation of Chlorophyll Content by Spectrophotometric Method.

Estimation of chlorophyll content in plant tissues by spectrophotometric method is a common and reliable technique. The most widely used method for this purpose is spectrophotometric determination of chlorophyll concentration using specific absorption peaks. Below, Table 2 shows Total chlorophyll content of jowar by the effect of soil treated DPJ during plant growth.

Table 2: Total chlorophyll content in *Sorghum bicolor* L. by the effect of soil treated DPJ during plant growth

No	Crop	DPJ used	Chlorophyll	Chlorophyll mg/100 g			
				Control	Total (a+b)	DPJ Treated	Total (a+b)
1.	Jowar	Delonix regia	a. b.	107.7 110.9	218.6	113.5 121.8	235.3

Results and Discussion

Table 3 show the lengths and the number of leaves of Sorghum plants by the effect of Delonix regia DPJ as compared with control. It was found that the length of the seedlings enhanced by *Delonix regia* (Bojer ex Hook.) DPJ on jowar length of plant.

Table 2 indicates the favourable result of the chlorophyll content in jowar crop by *Delonix regia* (Bojer ex Hook.) DPJ. The reason probably was the DPJ, as it is employed as a biofertilizer and is rich in nitrogen content and also it fixes nitrogen consisting of the root nodules. Sorghum leaves by the influence of *Delonix regia* (Bojer ex Hook.) also showed increase in both chlorophyll a and b. Chlorophyll pigments help leaves to capture light energy. In Earlier findings it was in record that DPJ contains nitrogen. Nitrogen content in plants signals the phytohormones. The resulting Deprotenised Juice is a concentrated solution containing a diverse range of bioactive compounds (Ritche.,1968). Furthermore, further studies are needed to elucidate the exact mechanisms of action of DPJ bioactive compounds and their potential effects in complex biological systems (Jadhav *et al*., 1998) [4]. Deproteinized Leaf Juice (DPJ) stands at the crossroads of sustainable resource utilization, offering a potent blend of plant-based nutrition, bioactive compounds, and resource efficiency (Phule and Sakdeo, 2023)

Table 3: Effect of *Delonix regia* DPJ on Height and number of leaves of Jowar plant

No. of plants	Height of the plants		Number of leaves	
	Control	DPJ	Control	DPJ
1	57.4	68.9	8	10
2	60.2	72.7	11	13
3	63.0	73.6	9	11
4	59.2	73.6	7	9
5	57.8	70.8	10	12
6	62.1	76.0	8	10
7	60.5	69.7	11	13
8	58.9	72.3	7	9
9	61.3	71.8	9	10
10	56.7	70.5	10	12
11	59.8	69.2	8	11
12	62.7	74.5	11	13
Mean	59.96	71.68	9.08	11.25
S.D.	1.99	2.09	0.52	1.44

Conclusion

It is concluded that the application of DPJ should also be tried on the foliage of the plants, crop of jowar found accepting the *Delonix regia* (Bojer ex Hook.) DPJ application in its soil by absorbing the nutrients and enhanced the rate of photosynthesis. The DPJ employed for the application used fresh concentrated. The overall results indicate that *Delonix regia* (Bojer ex Hook.) DPJ found beneficial for the increase in the chlorophyll content in the Jowar crop.

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