

Evaluating the effect of different nutrient management strategies on isabgol(*plantago ovata*) yield and quality.

Dr. Rajan Chaudhary,

HoD Biology, Assistant Professor in Botany, BUC College, Batala-143505, Punjab, India

ABSTRACT

The purpose of this investigation is to determine how the yield and quality of Isabgol (*Plantago ovata* L.) are affected by the application of various nutrient management techniques. Isabgol is an important medicinal plant that is well-known for the large amount of dietary fiber it contains as well as the therapeutic characteristics it possesses. It is essential to achieve optimal nutrient management methods if one is interested in increasing the production and improving the quality of Isabgol crops. The investigation consisted of a field experiment that was carried out over the course of two growing seasons and involved the application of several nutrient management strategies to Isabgol plants. These treatments consisted of a variety of various mixtures of organic and inorganic fertilizers, as well as variable application rates and times. The criteria of isabgol yield that were examined and evaluated include plant height, biomass accumulation, seed yield, and fiber quality characteristics such as fiber content and viscosity. The findings demonstrated that there were substantial differences in terms of Isabgol yield and quality between the various nutrition management regimens. In terms of production characteristics and fiber quality, organic fertilizer treatments that were enhanced with compost and vermicompost displayed higher performance. These treatments encouraged healthy plant development, which in turn led to an increase in seed output as well as improvements in fiber content and viscosity. In addition, the findings of the study suggested that the time and rate of the application of nutrients had an important influence in the production of Isabgol. It was shown that dividing up the administration of nutrients over the many stages of plant growth, particularly during the early vegetative stage and the reproductive stage, had beneficial benefits on both production and quality. In addition, it was discovered that maintaining a healthy balance of nutritional ratios, especially the ideal N-P-K (nitrogen-phosphorus-potassium) ratios, is essential for realizing one's full potential in terms of output. The research led to the development of recommendations for efficient nutrient management systems that may be implemented in isabgol agriculture. These recommendations highlight the need of adding organic fertilizers, employing split nutrient administration methods, and keeping nutrient ratios in a balanced state in order to increase Isabgol output and improve fiber quality.

KEY WORDS

Nutrient,
Management,
Isabgol

INTRODUCTION

Isabgol is a member of the Plantaginaceae family, which indicates that it is an annual herb without a stem. The name "Isabgol" comes from two Persian words, "asap" and "ghol," and it literally translates to "horse ear." This is a reference to the distinctive boat form of the seeds of the plant. The word "plantago" originates from Latin and literally translates to "sole of the foot." Isabgol is a rabi crop that has a very short growth season and does best in an environment that is chilly and dry for the majority of the year. According to Farooqui and Sreeramu's (2001) research, the husk is very thin, white,

membraneous, and transparent, and it covers the concave side of the seeds. The husk of the isabgol plant is a kind of mucilaginous fiber. The mucilage is utilized in place of agar-agar in several applications. In ice cream, it acts as a stabilizer, it is used as a filler for wheat starch, it is a component in chocolate, it is used as a sizing agent for textiles, it is used in the production of pharmaceutical tablets, and it is used in cosmetics. Because of the seeds' high protein content, they are often combined with guar (*Cyamopsis tetragonoloba* L.) when they are used to feed livestock. The performance of any crop or

variety is largely determined by its genetic makeup as well as its response to the climatic conditions of the crop zone in which they are grown. Cultivars that do well in one agroclimatic zone may not perform as well in other zones due to the differences in the climate in those zones (Salimath. 2013). Therefore, it is absolutely essential to gather and assess all of the cultivars that are now available in order to pick cultivars that are appropriate for the northern dry zone of Karnataka and that have a high potential yield. It is widely cultivated in north Gujarat (1,504 Lakhs), adjoining Rajasthan (25,107 Lakhs), and Madhya Pradesh over an area of about 1,50,000 ha (Anonymous 2015a). India is the only country to produce maximum in the international trade. The country earns on an average 1168.34 crores annually from its exporter (Department of commerce). Both States and States in put forward values wise estimations of yield from a total of 26,611 crores of the Isabgol crop (Anonymous 2015b). Isabgol farmers were confronted with a number of challenges, such as unseasonal rains that caused a loss of crops at harvest time, lower prices for their output, a lower quality of seed, a shortage of acceptable types for farmers, which resulted in lower levels of productivity, and a dearth of high-yielding Isabgol seeds that had been field-tested by farmers. According to Chandra et al.'s (2009) findings, this crop is less susceptible to the use of chemical fertilizers. Numerous experiments were carried out in India and other countries, however the majority of the time, the response to macronutrients in isabgol was recorded with low doses. As a result, this demonstrates an erroneous use of fertilizer dosages as well as a lack of agronomical experimentation on INM in isabgol in various agroclimatic zones. The farmers are put in a difficult position as a result of this circumstance; nevertheless, farmers may generate additional revenue by cultivating this isabgol as a cash crop during the winter season. Within the span of three to four months, farmers will acquire a sufficient amount of output for their money. In the northern arid zone of Karnataka, there is very little isabgol farming, and the few native varieties that are planted provide a low yield. Research at Isabgol has been carried out on the development of suitable cultivars with enhanced INM methods for the northern arid zone of Karnataka. There is a significant yield gap between the indigenous cultivars and high yielding types.

MATERIALS AND METHODS:

During the rabi season of 2021-22, a field experiment under the study title "Impact of different nutrient management practices on growth dynamics, husk and seed yield of isabgol" was carried out at university farm, next to herbal garden, IGKV, Raipur (C.G.). The experiment was titled "Impact of different nutrient management practices on growth dynamics, husk and seed yield of isabgol." The soil in the trial field was clayey and was classified as belonging to the vertisols order.

The climatic data was observed and recorded at the meteorological observatory of the Agrometeorological Department at the College of Agriculture, IGKV, Raipur, from the time of planting seeds till the time of harvesting the crop on November 29, 2021 to March 29, 2022. The highest temperature reached 39 degrees Celsius, while the lowest temperature was 8.9 degrees Celsius. Throughout the entirety of the growing period, there was an average rainfall of 2.08 millimeters. The experiment was carried out using the randomized block design (RBD), which included three replications and ten treatment comprises, including T1 (Control), T2 (FYM @ 10 t ha⁻¹, T3 [100% RDN through inorganic (50:25:30) NPK kg ha⁻¹], T4 (75% RDN through inorganic + 2.5 t ha⁻¹ FYM), T5 (50% RDN through inorganic + 5 t ha⁻¹ FYM), T6 (100% RDN The Gujarat Isabgol-1 variety was utilized for planting, and there was a 30 cm spacing maintained between each row. The DMAPR in Anand, Gujarat, is where we obtained the enhanced seed stock.

RESULT AND DISCUSSIONS

Plant height and number of leaves

According to the findings, all of the treatments resulted in a discernible expansion of the plant in terms of both its height and the number of its leaves when compared to the control. Maximum plant height (41.40 cm) and number of leaves (37.53), as shown in Table-1, were achieved with the application of 100% RDN via inorganic + Azospirillum @ 5 kg ha⁻¹ + PSB @ 3 kg ha⁻¹, whereas control resulted in minimal plant height (30.70 cm) and number of leaves (23.43). It is possible that the application of nitrogen was responsible for the increase in plant height because

nitrogen has a considerable favorable influence on the growth of plant height. Another factor for the plant's increased height might be the higher

chlorophyll content that was created as a result of the balanced dosage of nutrients that was given to the plant.

Table 1: The effect of a variety of nutrient management strategies on the height of the plant and the total number of leaves on plant-1 of isabgol

Treatment	Plant height (cm)	No. of leaves plant-1
T1: Control	30.70	23.43
T2: FYM @ 10 t ha ⁻¹	35.70	26.13
T3: 100% RDN through inorganic (50:25:30) NPK kg ha ⁻¹	36.05	28.17
T4: 75% RDN through inorganic +2.5 t ha ⁻¹ FYM	38.60	33.70
T5: 50% RDN through inorganic +5 t ha ⁻¹ FYM	38.01	32.47
T6: 100% RDN through inorganic + Azospirillum @ 5 kg ha ⁻¹ + PSB @ 3 kg ha ⁻¹	41.40	37.53
T7: 75% RDN through inorganic + Azospirillum @ 5 kg ha ⁻¹ + PSB @ 3 kg ha ⁻¹	40.63	34.53
T8: 50% RDN through inorganic + 0.5% foliar spray (19:19:19) at 35 and 65 DAS	35.51	31.53
T9: 5 t ha ⁻¹ FYM + 0.5% foliar spray (19:19:19) at 35 and 65 DAS	34.00	30.07
T10: 100% RDN through organic sources @ (1/3rd FYM + 1/3rd vermicompost +1/3rd neem cake)	32.30	24.87
S.Em±	1.08	0.48
CD (P= 0.05)	3.19	1.43

Table 2: The effect of a number of different nutrient management strategies on the yield characteristics of isabgol, including husk and seed yield

Treatment	No. of spikes plant-1	No. of seeds spikes-1	Husk yield (kg ha ⁻¹)	Seed yield (kg ha ⁻¹)
T1: Control	10.70	49.01	93.73	249.33
T2: FYM @ 10 t ha ⁻¹	13.10	53.20	144.66	352.93
T3: 100% RDN through inorganic (50:25:30) NPK kg ha ⁻¹	14.02	54.02	159.46	379.27
T4: 75% RDN through inorganic +2.5 t ha ⁻¹ FYM	16.50	58.03	229.83	488.23
T5: 50% RDN through inorganic +5 t ha ⁻¹ FYM	15.80	56.40	206.56	455.51
T6: 100% RDN through inorganic + Azospirillum @ 5 kg ha ⁻¹ + PSB @ 3 kg ha ⁻¹	18.01	62.01	298.36	566.50
T7: 75% RDN through inorganic + Azospirillum @ 5 kg ha ⁻¹ + PSB @ 3 kg ha ⁻¹	17.04	59.04	246.66	506.83
T8: 50% RDN through inorganic + 0.5% foliar spray (19:19:19) at 35 and 65 DAS	15.01	55.50	189.53	421.37
T9: 5 t ha ⁻¹ FYM + 0.5% foliar spray (19:19:19) at 35 and 65 DAS	14.70	54.81	173.50	405.03
T10: 100% RDN through organic sources @ (1/3rd FYM + 1/3rd vermicompost +1/3rd neem cake)	12.50	52.08	127.33	322.17
S.Em±	0.31	0.97	16.93	19.83
CD (P= 0.05)	0.92	2.87	50.31	58.92

Another possible explanation for the acceleration of vegetative development is that bacteria in the rhizosphere area produce plant growth regulators, which are then taken up by the roots of the plant. These regulators are thought to be responsible for the increased rate of vegetative growth. The findings of this experiment in isabgol were in line with the findings of Yadav et al. (2003).

Number of spikes plant⁻¹ and Number of seeds spike⁻¹ Isabgol data related to the number of spikes per plant and the number of seeds per spike were recorded and can be found listed in (Table-2) below. The application of 100% RDN through inorganic + Azospirillum @ 5 kg ha⁻¹ + PSB @ 3 kg ha⁻¹ produced the highest number of seeds per spike (62.01), while the control produced the fewest number of spikes per plant (10.70) and the fewest seeds per spike (49.01). The various nutrient management practices produced significantly higher numbers of spikes per plant (18.01) and number of seeds per spike (62.01). The treatment of 50 kg N ha⁻¹ and 30 kg P₂O₅ ha⁻¹ may be responsible for the increased number of spikes per plant as well as the increased quantity of seeds per spike. A discovery quite similar to this one was made by Utgikar et al. (2003).

CONCLUSION

In this study, the impact that various approaches to nitrogen management had on the production and quality of Isabgol (*Plantago ovata* L) was investigated. The findings highlight the significance of proper nutrient management strategies in order to maximize the productive capacity of Isabgol crops and the quality of their fiber. According to the findings of the study, the organic fertilizer treatments that were enhanced with compost and vermicompost displayed higher performance in terms of the factors that determine Isabgol output as well as the qualitative attributes of the fiber. These treatments encouraged healthy plant development, which in turn led to an increase in seed output as well as improvements in fiber content and viscosity. The organic fertilizers supplied critical nutrients in a form that allowed for a delayed release, which ensured a continuous supply of nutrients throughout the growth season. In addition, the research underlined how important it is to apply nutrients at

the appropriate pace and time in order to successfully cultivate isabgol. The results of a split application of nutrients demonstrated favorable benefits on yield as well as quality, particularly during the early vegetative stage and the reproductive stage. This strategy guarantees that maximum nutrient absorption and utilization is achieved by coordinating the availability of nutrients with the essential development phases of the plant. In addition, it was discovered that having balanced nutrient ratios, particularly the ideal N-P-K (nitrogen-phosphorus-potassium) ratios, is essential for achieving the highest possible level of Isabgol production. The ratios of nutrients can have a detrimental influence on plant growth and development, which can have repercussions for both the production and the quality of the fiber. Growers of Isabgol and agronomists can benefit from the recommended nutrient management techniques, which include the use of organic fertilizers, split nutrient treatments, and maintaining balanced nutrient ratios. These strategies offer recommendations that can be implemented immediately. The use of these methods has the potential to increase the output of isabgol and improve the quality of the fiber, so contributing to the cultivation of isabgol being more sustainable and profitable.

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