Article ID 240202047

Utilisation of Pond dyke for King chilli Cultivation to Enhance Productivity and Income of Farmers of Northeast India

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In India, where agriculture is crucial for livelihoods but faces challenges like declining land availability, integrated farming emerges as a solution. This approach combines multiple farm commodities to boost profits, minimize infrastructure, and optimize costs. With the majority of farmers being small or marginal landholders, integrated farming becomes essential for economic improvement while maintaining sustainability. However, lack of awareness and working in diverse, risk-prone environments hinder widespread adoption. Integrating fish farming with horticulture proves effective, utilizing dykes and trellises around ponds for horticultural production, maximizing profits per unit area, and overcoming irrigation challenges. This type of integrated system provides 20-25% higher returns compared to aquaculture (Kumar et al., 2015). In freshwater integration, plants such as papaya, banana, mango and coconut are suitable with pineapple, chilli, turmeric and ginger as intercropping plants. In the case of vegetables, tomato, cabbage, cauliflower, carrot, radish, cucumber and lady's finger, etc. are commonly utilized. King chilli, scientifically known as *Capsicum chinense* Jacq., is a cultivated species indigenous to the North Eastern Region of India. It is considered a natural outcrossing variant between *C. chinense* and *C. frutescens*, closely related to the former. Widely grown in the region, it serves both as a vegetable and a spice, renowned for its exceptionally high capsaicin content, making it two to four times hotter than regular chilli and holds significant market value. Therefore, the integration of king chilli farming in the dyke of fish pond can increased the productivity as well as uplift the economy of farmers of north eastern India. The dykes of the fish ponds which are otherwise unutilized give scope to integrate horticulture plants in the same. The plants should be dwarf variety to avoid the shading of the ponds, suitably seasonal and economically viable one.

Description of King chilli (*Capsicum chinense* Jacq.)

King chilli, scientifically known as Capsicum chinense Jacq., is a unique and highly sought-after chilli pepper variety indigenous to the North Eastern Region of India. It typically grows as a small to medium-sized shrub, reaching heights of up to several feet. It is renowned for its extreme pungency, which is attributed to its exceptionally high capsaicin content. In fact, it is considered one of the hottest chilli pepper varieties globally, with a Scoville Heat Unit (SHU) rating that can exceed 1 million units. This intense heat makes it significantly hotter than common chilli varieties. Due to its exceptional heat and distinct flavor, king chilli commands a premium price in local and international markets. It is often sought after by spice enthusiasts, chefs, and food manufacturers for its culinary applications and medicinal properties. While primarily cultivated in the North Eastern Hill Region of India, particularly in states like Nagaland, Manipur, and Assam, king chilli has garnered global recognition and is exported to various countries worldwide.

Integrating chilli farming in fish pond dykes

It can be a beneficial practice that optimizes land use and enhances overall farm productivity. In a farm pond, about 40-60% area is under pond dykes. In most cases pond dykes are either underutilized or left fallow. But these unutilized spaces could be used for intensive production of high value vegetable crops

like king chilli round the year since water is available throughout the year

Preparation for cultivating king chilli

i. **Selection of Chilli Varieties:** King chilli (*Capsicum chinense* Jacq.) is one of the cultivated Capsicum species which is indigenous to North Eastern Region of India. This species is considered to evolve through natural outcrossing and occupies a taxonomic position between *C. chinense* and *C. frutescens*, clustering more closely with *C. chinense* group

ii. **Preparation of Dyke Areas:** Utilize the elevated areas of the fish pond dykes for chilli cultivation. Ensure that the dyke soil is well-drained and fertile for optimal chilli growth.

iii. **Field preparation:** King chilli is transplanted in pits. About 30 x 30 x 30 cm size pits are dug out during 1st week of March. Pit to pit distance is kept 1.2 x 1.2 m. During final preparation, pits should be filled with mixture of top soil, biofertilizer, Tricoderma and FYM (Vimera et al., 2012).

iv. **Planting:** Seedlings of King chilli are ready for transplanting in 7-8 weeks after sowing when they attain 5-6 leaves. One week before transplanting, irrigation should be reduced. This will facilitate hardening of seedling to tolerant transplanting shock. Before planting, seedlings should be dipped for 30 minutes in 2 kg Azotobacter and 2 kg Phosphotika in 20 litres of water.

v. **Irrigation:** Set up an irrigation system to provide water to the chilli plants as needed. This may involve drip irrigation, sprinkler systems, or hand watering, depending on the scale of the operation and water availability.

vi. **Manures and fertilizers:** Research has shown that King chilli, much like other solanaceous crops, is a heavy feeder and benefits significantly from nutrient supplementation. Integrated nutrient management approaches have been found to optimize both yield and quality. One study by Vimera et al. (2012) demonstrated that the application of 45:30:30 kg NPK ha^{-1}, along with 10 tons FYM ha^{-1}, and the use of biofertilizers such as Azotobacter and Phosphotika, resulted in maximum yield and quality of King chilli. Conversely, organic farming methods have also shown promising results. Another study by Ningthoujam et al. (2017) found that in organic systems, the application of 20 tons FYM ha-1 resulted in maximum yield and quality of King chilli.

vii. **Pest and Disease Management:** Monitor the chilli plants regularly for signs of pests and diseases. Implement integrated pest management strategies, such as companion planting and biological controls, to minimize pest damage and reduce the need for chemical pesticides.

viii. **Harvesting and yield:** King chilli, from transplantation to harvesting, typically takes around 60-70 days. Harvesting commences in June and extends over approximately three months, reflecting the staggered ripening of fruits. To ensure optimal yield and quality, harvesting should be conducted at weekly intervals. The harvesting process involves three distinct stages:

a. **Green Stage:** At this stage, the chillies are still immature and green in color. They are firm to the touch and have not yet developed their full heat and flavor profile. Harvesting at this stage is suitable for certain culinary applications that require the use of green chillies.

b. **Yellow Stage:** As the chillies continue to ripen, they transition to a yellowish hue. At this stage, they are partially ripe, offering a balance between heat and sweetness. The chillies are firmer than fully ripened ones but softer than those harvested at the green stage.

c. **Fully Ripened Stage:** At this stage, the chillies have reached their maximum maturity and develop their characteristic red color. They are fully ripe, offering the highest heat levels and flavor intensity. Fully ripened chillies are preferred for their rich flavor and are commonly used in various culinary dishes and for making spice powders and sauces.

ix. **Market Access:** Explore local markets, grocery stores, restaurants, and other potential buyers to sell your harvested chilli peppers. Consider value-added products like dried chillies or chilli-based sauces to diversify your product offerings.

Some guidelines for pond preparation (Kumar & Dubey, 2006).

i. **Selecting the Site:** Choose a location that receives adequate sunlight, preferably away from sources of pollution and runoff. The soil should be suitable for retaining water.

ii. **Pond Design and Construction:** Construct the pond according to its intended purpose, considering factors such as size, depth, and shape. Ensure proper drainage and water inflow/outflow systems.

iii. **Water Source:** The pond should have a reliable water source to maintain water levels and quality. It could be from groundwater, streams, or a controlled water supply.

iv. **Soil Treatment:** Before filling the pond with water, treat the soil to seal it and prevent water leakage. Techniques such as compacting, puddling, or lining with materials like clay can be used.

v. **Water Quality Testing:** Test the water for parameters such as pH, temperature, dissolved oxygen, and nutrient levels. Adjust the water quality as needed through measures like aeration, fertilization, or pH adjustment.

vi. **Weed and Predator Control:** Remove any unwanted vegetation and predators from the pond to prevent competition for resources and predation on the fish.

vii. **Introducing Beneficial Organisms:** Introduce beneficial organisms like plankton, which serve as natural food sources for the fish, promoting a healthy ecosystem.

viii. **Stocking Fish:** Once the pond is prepared and water quality is optimal, introduce fish gradually, considering factors such as species compatibility, stocking density, and size of fish.

ix. **Feeding and Management:** Provide appropriate feed for the fish based on their nutritional needs. Monitor water quality regularly and manage any issues promptly to ensure the health and growth of the fish.

x. **Harvesting and Maintenance:** Harvest fish at the appropriate time to prevent overcrowding and maintain optimal growth rates. Regular maintenance tasks such as pond cleaning, vegetation control, and equipment upkeep are also essential.

Conclusion

The integration is beneficial as the pond water can be used for irrigation and the irrigated water comes back to the pond along with nutritive silts and thus acts as manure for the pond. In freshwater integration, plants such as papaya, banana, mango and coconut are suitable with pineapple, chilli, turmeric and ginger as intercropping plants. In a study farmers recorded an average yield of 34.48 Q/acre and earn a net return of Rs.11,18,400/acre (sale price of fruit @ Rs 450 kg-1) with a high B:C ratio (2.58). Thus, with this intervention the selected farmers not only improved their livelihood but also achieved sustainability. As this crop has a great market demand and can fetches high price in both domestic as well as international market small and marginal farmers should be encouraged to adopt its cultivation on commercial scale through its proper cultivation techniques so as to generate high net return per unit area and enhanced their livelihood. Moreover, the integration of fish with other farming activities helps farmers to provide proper pond management for increased production.

References

Ningthoujam, S. P. Kanaujia and A. Jha, 2017. Influence of date of planting and FYM levels on growth, yield quality of King chilli (*Capsicum chinense Jacq.*). Progressive Horticulture, 49(2):158-163.

Vimera, K., S.P. Kanaujia, V.B. Singh and P.K. Singh, 2012. INM for quality production of King chilli (*Capsicum chinense* Jacq) in Acid Alfisol. Journal of the Indian Society of Soil Science, 60 (1):45-49.

Kumar, A., & Dubey, P. (Eds.). (2006). Fish Management and Aquatic Environment. Daya Books.

Kumar, P., Khar, S., Dwivedi, S., & Sharma, S. K. (2015). An overview of fisheries and aquaculture in India. Agro-Economist, 2(2), 1-6.

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