

CHALLENGES FOR RICE PRODUCTION TECHNOLOGY TRANSFER AND ADOPTION IN FIJI

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PRESENTATION OVERVIEW

- Geography
- Climate of Fiji
- Challenges to Technology Transfer
- Challenges to Technology Adoption
- Conclusion



1.0 GEOGRAPHY OF FIJI

- Lies in the heart of the Pacific Ocean between longitudes 174°East and 178°West of Greenwich and latitudes 12°S and 22°South.
- Exclusive Economic Zone - approximately 330 islands of which only 109 islands are inhabited and covers about 1.3 million sq.km of the South Pacific Ocean.
- Fiji's total land area is 18,333km² dispersed in the territorial waters of around 141,800km².
- There are two major islands – Viti Levu (10,429km²) & Vanua Levu (5,556km²).
- Islands are predominantly volcanic and rise to an elevation of around 1,000m above sea level.



1.0 GEOGRAPHY (Cont...)

- Total land area of 1.8 million hectares, 16% of the land is suitable for Agriculture found along coastal plains, river deltas and valleys of the two major islands.
- Total population is 837,271 comprising of 475, 739 Indigenous Fijians, 313,798 Indo-Fijians and 47,734 of other races.
- Major commercial crop has been sugarcane.
- Agriculture had been the backbone of the economy accounting for 43 % of Fiji's foreign exchange earnings and provides 50% employment. For the last decade, and its contribution to the national GDP has declined from 20% to around 9.5% (2009) over the past decade.



2.0 MAP OF FIJI

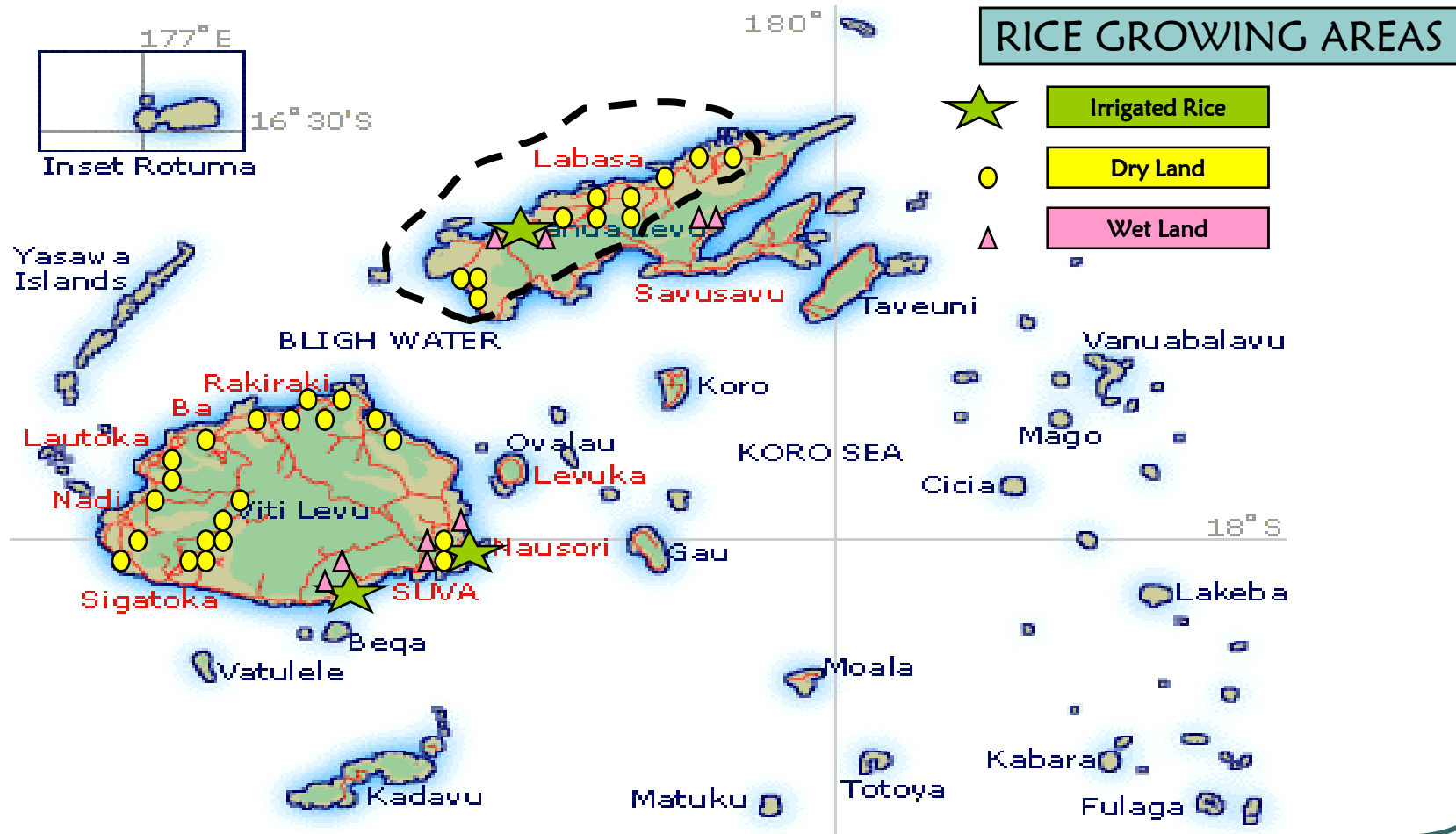


3.0 CLIMATE IN FIJI

- Tropical South Sea maritime climate – Cooler months (May to October) with average temperature of 22°C (dry season) and hot-wet months (November to April) with average higher temperatures of 28°C (wet season).
- Rainfall: average annual rainfall varies from 1,500 to 4,000 mm. 80% rainfall recorded in the wet season and 20% in the dry season.
- Total sunshine hours: 1760 to 2200, max. in cooler (off) season (8-9 hrs/day) and min. in warmer (main) season (4-5 hrs/day).
- This climatic condition of Fiji favors rice growth and development for year round.
- There are two rice planting seasons, which are Main-season (Nov-Apr) and Off-season (July-Aug).
- Three types of rice farming systems are practiced:
 - Irrigated – 20% of the total land production area.
 - Rainfed Wetland – this is the dominant system of production of rice in Fiji, where it comprises about 44% of the total land production area. This system has the potential of two cropping cycle in a year in the wet zones. About 80% of the wetland crop is traditional varieties.
 - Rainfed Dryland – rice is grown only in the main season (36% of the total production area) where mostly it is intercropped with other dry land crops, mainly sugar cane. This is a predominately sugar cane production zone.



4.0 RICE PROFILE IN FIJI



4.0 RICE PROFILE IN FIJI (CONT...)

- Rice has been cultivated for many decades in Fiji, becoming one of the major income-generating commodities in Northern and Central division.
- In 1986, Fiji was 75% self sufficient in rice, however the production trend started to fall drastically as a result of :-
 - deregulation in 1990,
 - Coupled with changes in the policy (removal of subsidies & licensing, and imposing duty tariffs on imported rice ,
 - Irrigation Act, which was also revoked in 1994 ceasing all the services by Department of Agriculture and withdrawal of all the required inputs (agro inputs, machine, water etc),
 - alternative uses for productive resources notably land and labor,
 - expiry of land leases,
 - lack of interest by farmers and younger generation,
 - lower demand for local rice,
 - natural disasters,
 - high cost of production, and
 - lack of credit in rural areas.

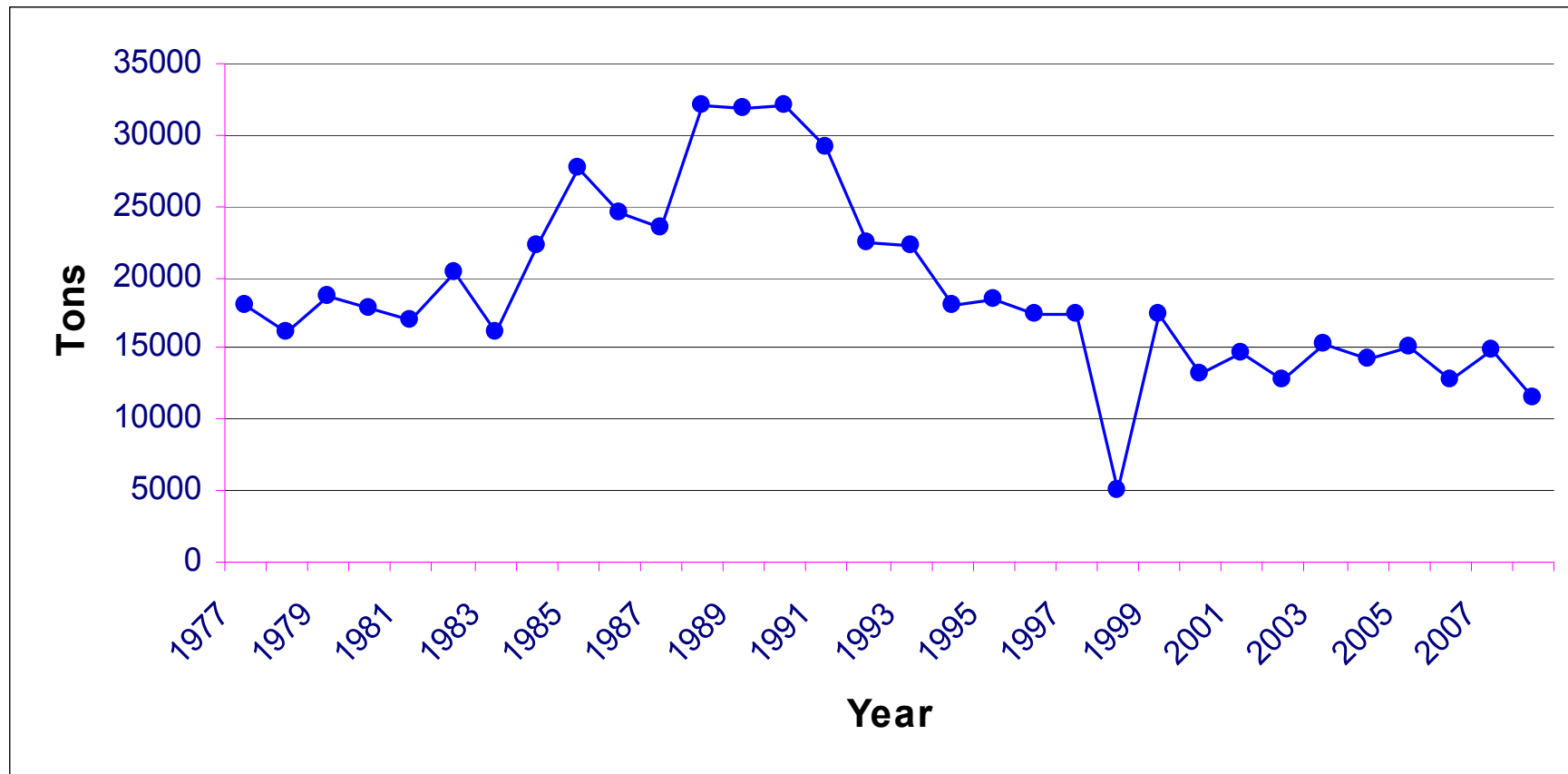


4.0 RICE PROFILE IN FIJI (CONT...)

- Rice is a common food for all ethnic groups in Fiji now and the per capita consumption rose from 64 to 75kg.
- At the current rate of population growth (0.8%) Fiji's rice demand is expected to grow into an additional requirement of 500 to 600 t/annum.
- The current production has been at < 12,000 tons or at 12% self sufficiency.
- The current average yield of rice in Fiji is 2.5 t/ha.
- Ever growing demand, production not kept pace with consumption.
- Widening domestic deficit met by importation (\$21 million/year).
- As of today, Fiji is reliant on imported rice from overseas at the value of \$40 million for 49,784 tons of rice for 2010 from near by rice growing countries such as Australia, Thailand and Vietnam.



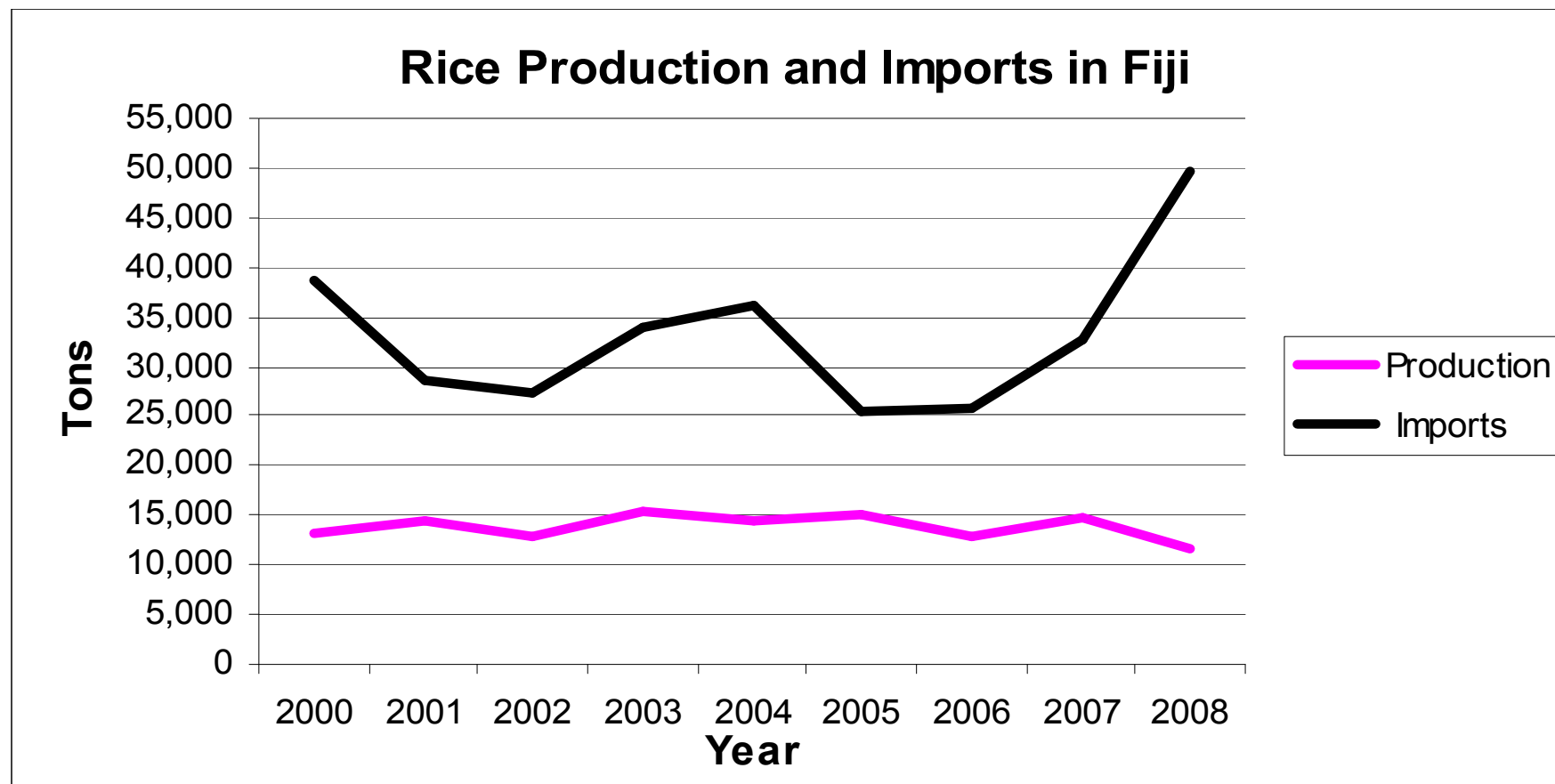
4.1 RICE PRODUCTION 1977 - 2008



Data: EP&S MPI 2009.



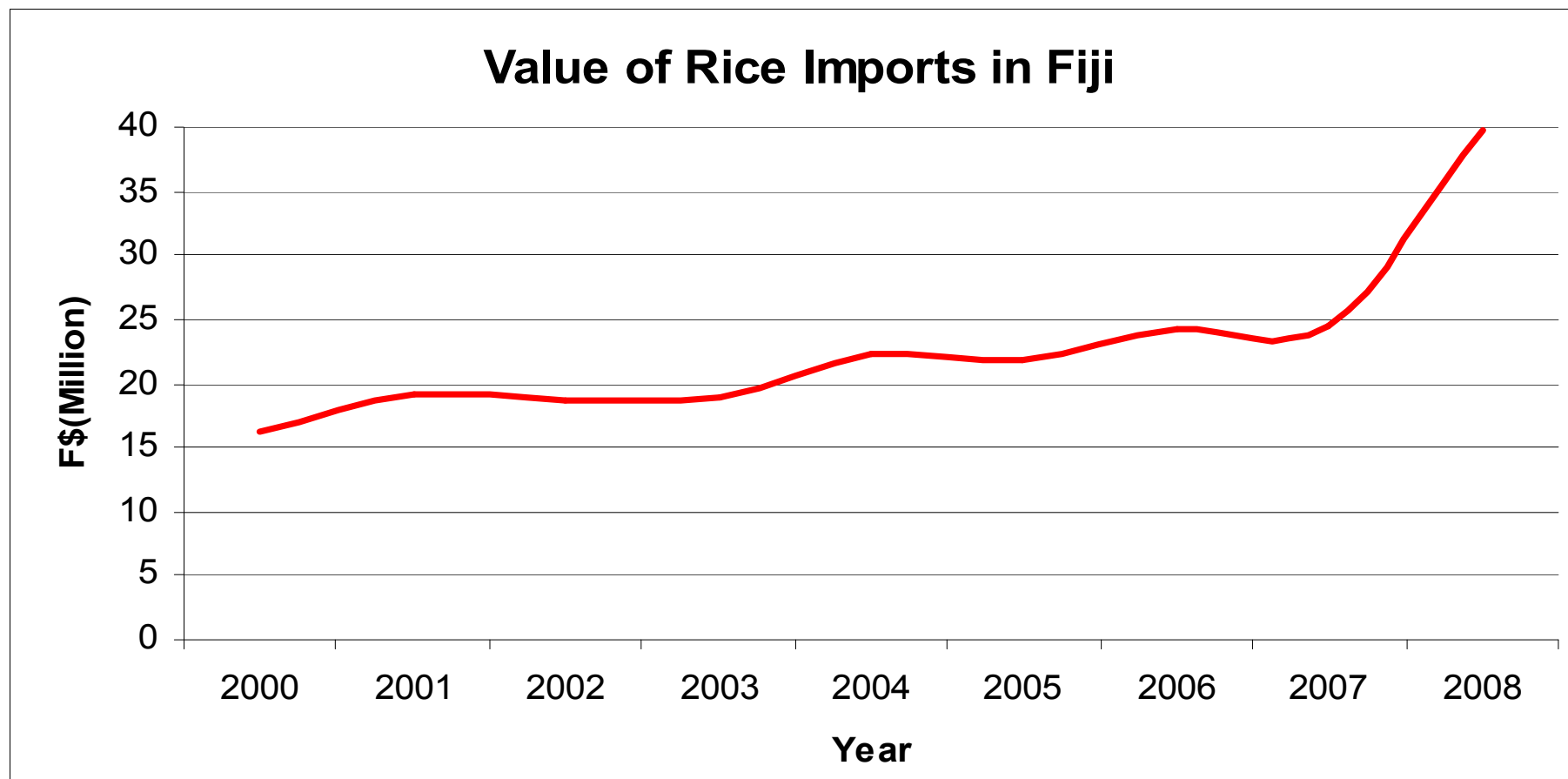
4.2 RICE PRODUCTION AND IMPORTS



Data: EP&S MPI 2009.



4.3 VALUE OF RICE IMPORTS



Data: EP&S MPI 2009.



5.0 TECHNOLOGY TRANSFER

- Among the many factors that contribute to growth in agricultural productivity especially rice in Fiji, technology is the most important.
- One of the prerequisites for effective technology transfer on rice production is the appropriate technology which refers to a technology package which must be technically feasible, economically viable, socially acceptable, environmental-friendly, consistent with household endowments, and relevant to the needs of farmers.
- The paramount challenges to effective technology transfer in Fiji and play a pivotal role in Rice Production are Government Policies, Types of technology, and Extension Services.



5.1 POLICIES

- Government policies provide the environment to benefit, improve productivity, alleviate poverty, ensure sustainability, protect the environment and provide food security.
- It is therefore imperative that through appropriate policies, socio-economic adjustments should be effected in terms of input-output pricing, institutional support and to redress the needs of rice farmers in order to complement the technology gains.
- The challenges of technology transfer in Fiji hinges on this policies:
 - Structure the import duties in a manner so as to provide adequate protection against cheap imports of rice, which will adversely affect domestic prices and production.
 - Custom-hire facilities for essential farm machinery & Liberal credit facilities
 - Procurement policies and storage and market facilities.
 - Encourage export subsidies and continue to provide input subsidies.
 - Encourage greater private sector participation in activities like seed production, input supply and direct farmer-processor linkages.
 - Initiate comprehensive land reforms which can agreeable to all.



5.2 TYPE OF TECHNOLOGY

- The major problem for rice development in Fiji will be the type of technology that would be most suitable for the economic environment of the future.
- The high energy (Oil & Fuel) prices are likely to continue over the next several decades. Fiji heavily relies on overseas for oil, agro-inputs such as chemicals and fertilizers. As the price of oil increases so do the prices of this agro-inputs.
- If the appropriate technology for future is to be based partially or fully mechanized and with intensive use of agro – inputs, then this will pose a major challenges to the transfer of technology and be a production constraint.
- Labour intensive technologies will also not be accepted due to shortage of labours for rice production.
- Farms in Fiji differ widely in terms of soil fertility, water availability, and proximity to collection and market centers etc.
- The better the production environment, the greater the profitability of adoption.



5.3 EXTENSION SERVICES

- Extension services in Fiji is divided within four divisions of the country and the Officers are distributed as widely as possible in all the main agricultural zones who are in close and continuous contact with farmers.
- Their role is to diffuse the research results (technology transfer) to the farmers on all crop commodities not only in rice and provide infrastructural support for improvement of the agricultural sector.
- Extension services have also become heavily involved in a wide range of activities: input supply, administration of credit, market, policing of regulations and collection of statistics etc.
- The low level of extension/research linkages in delivering research results to farmers and the need to properly extend appropriate cultural practices for high yielding varieties is lacking in Fiji.
- Lack of knowledge and skills, staffing level (1:1,200 farmers), harsh working conditions and housing, remoteness and communication, less resources such as transportation, many crops to look after, are the attributes to low level of technology transfer in Fiji especially to rice production.



6.0 TECHNOLOGY ADOPTION

- The rate of adoption of new technology is subject to its profitability and the degree of risk.
- The challenges for adoption of rice technologies in Fiji include land tenure, preferences to traditional varieties, farm size, net farm income, human capital consisting of the age of farmers and labour availability, credit facilities and the risks.



6.1 LAND & TENURE

- The insecurity and risk with regards to land leases (tenure) has led to one of the falling confidence in the rice industry in Fiji. This has depressed technology and its farm investments, which has had a significant negative impact on rice production.
- The rural urban migration in Fiji will continue following the expiring of land leases, insecurity of land, breakdown in social structures, displaced people and extension of town boundaries.
- Urban population has increased by 29.8% in the ten-year period (1986 – 1996) and rural population has decreased by 2.5% for the same period.
- Many Indo-Fijian farmers, along with their families, have been displaced from their homes which due to land tenure system in Fiji, where most of sugarcane and rice farms are on native land on 30-year land leases. These leases began to expire in 1997 with a high rate seen in 1999 and 2000.

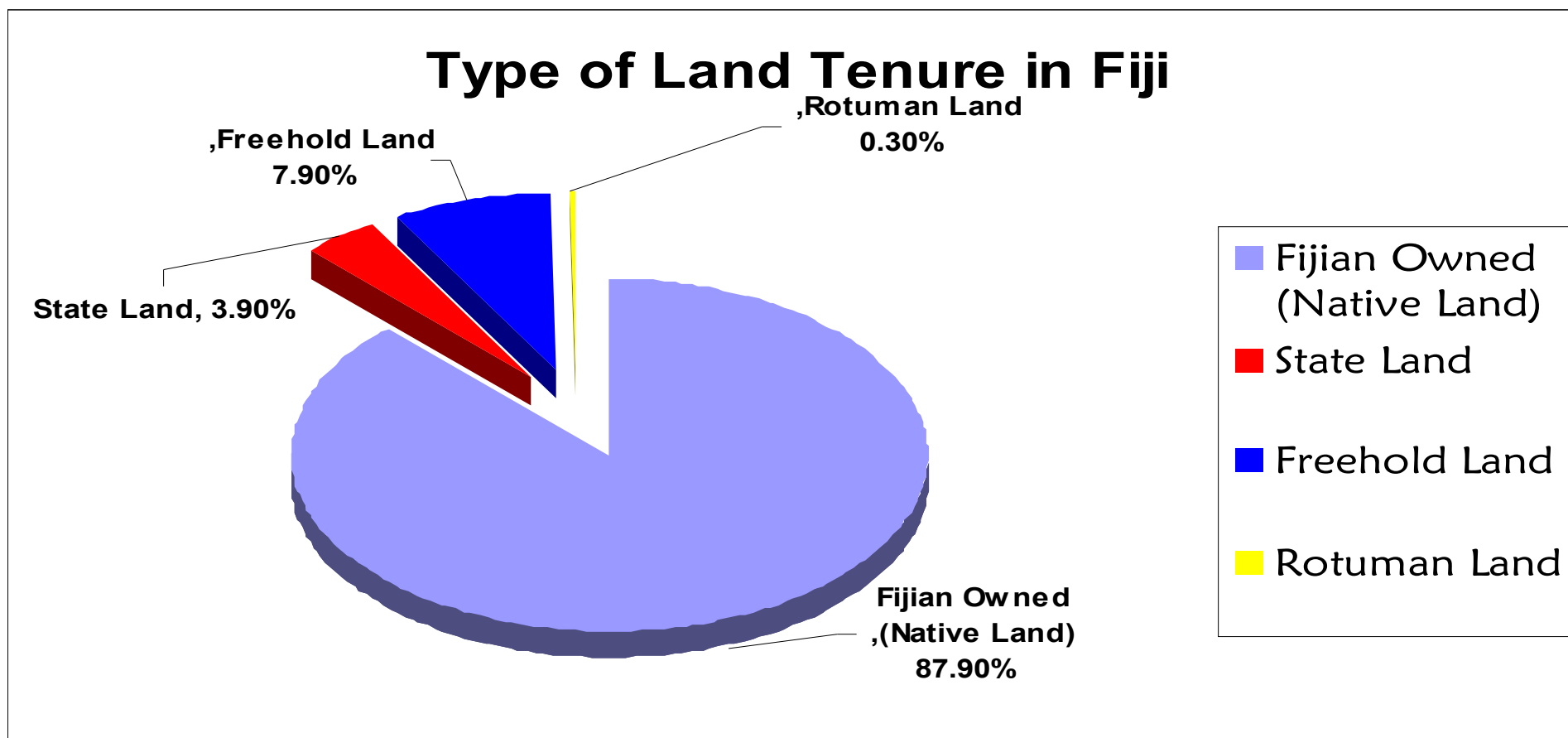


6.1 LAND & TENURE (CONT..)

- The refusal to renew leases has not left much option to these farmers but to move to urban squatter areas in search of unskilled work.
- This movement results in a major drain of skilled rice farmers and workers resulting in labor scarcity.
- The major problem for further development of rice cultivation will be the availability of land suitable land both physically and in terms of tenure access in Fiji.
- Farmers who own their land are more likely to adopt changes and expend than those who do not own their land.
- The issue here has more to do with security of tenure than ownership per se.
- This has a significant impact on the technology transfer and adoption on the farm productivity.



6.1 LAND & TENURE (CONT...)



6.1 LAND & TENURE (CONT...)

Expiring of Agricultural Land Leases in Fiji

Year	No. of Leases	Year	No. of Leases	Year	No. of Leases
1997	135	2008	299	2018	254
1998	237	2009	278	2019	306
1999	1594	2010	374	2020	152
2000	1955	2011	445	2021	168
2001	458	2012	419	2022	135
2002	622	2013	487	2023	148
2003	432	2014	380	2024	88
2004	600	2015	784	2025	85
2005	463	2016	361	2026	65
2006	521	2017	177	2027	54
2007	652			2028	13
Total	13,141				

Source: NLTB 2006



6.2 PREFERENCES TO TRADITIONAL VARIETIES

- About 85% of Fiji farmers cultivate rice as rain-fed and upland condition.
- The traditional rice varieties (80%) are grown widely throughout the country cultivated without fertilizer and management practices.
- These traditional varieties have been used by the farming communities long ago, so that farmers have gotten used to them and are not ready to abandon them.
- In spite of low yield (1.2t/ha), tall, longer duration of the traditional varieties, farmers in upland and rain fed areas prefer to plant these varieties because of un-adaptability in agronomic and economic condition, eating preferences and grain quality.
- Compared to the improved rice varieties such as Boldgrain, Uttam, Maleka, Deepak, Totoka, Nuinui and Star are shorter duration varieties that are high yielding (3 - 6 t/ha) have resistance pests & to lodging, semi-dwarf and more nitrogen response in their yield.
- Farmers are reluctant to spend money on important inputs as fertilizers and pesticides, and the uncertainty about the amount of distribution of rainfall.



6.2 PREFERENCES TO TRADITIONAL VARIETIES

Traditional Variety



Improved Variety



6.3 FARM SIZE

- The farm size varies considerably between the provinces in Fiji and may influence rice technology adoption in Fiji.
- Majority of the farms (43.9%) are < 1 ha and are mostly located in the sugar cane growing areas such as Ba, Nadroga, Navosa, Ra and Macuata provinces.
- This equates to high percentage of farmers being subsistence in nature.
- The farm sizes of irrigated areas in Fiji is as large as 1 - 2 ha.
- Farmers with smaller sized farms are likely to make less effort in adoption than with larger farms and may act also as socio-economic indicators such as access to credit etc.
- Small farms can limit the adoptability due to high fixed costs in Fiji, (Example: Tractor, irrigation, bullocks, equipments etc) which is primary barrier to adoption.
- Farmers with large farms are more likely to adopt technology and also more likely to remain adopters.
- Their land resources means they can devote a relatively small percentage of arable land to new technology, while still having enough buffer land to plant their regular crops and still be assured of those economic returns.



6.2 FARM SIZE (CONT..)

Number of farms and Total Area by Size of Farms at National Level

Size of Farm (ha)	Farms	% of Farms	Total Area (Ha)
<1	28,564	43.9	11,819.62
1 – 5	25,113	38.7	60,598.86
5 – 10	6,915	10.6	46,865.78
10 - 20	3,040	4.7	41,491.45
20 - 50	990	1.5	29,118.39
50 - 100	285	0.4	21,397.38
>100	126	0.2	40,567.34
Total	65,033		25,1858.83

Source: National Agriculture Census 2009



6.3 NET FARM INCOME

- Low net farm income will tend to reduce the probability of adopting a technology that is of capital-intensive in Fiji.
- Farm productivity can be affected by production cost or total revenue changes by introduction of technologies requiring costs.
- The level of net farm income is expected to affect rice production effort because farmers with higher net income are less likely to be financially constrained to adopt new rice production technologies.
- Ethnic Fijians farmers, relative to the Indo-Fijian farmers, have demonstrated low adoption as they are financially unable to support this such as purchase of fertilizer, weedicide and machinery.
- Profit per ton amongst Fiji's rice farmers is quite marginal. The rice farmer make a profit of \$2,800/ha/yr for Rain fed cultivation and \$3,600/ha/yr for Irrigated rice. This income is well below the poverty line income of \$7,000.
- The farmers survive by substituting family labour for hired labour wherever possible as well as by engaging in off-farm employment.
- Farms sizes from 1 – 5ha derive higher percentage their income from farm.



6.3 NET FARM INCOME (CONT..)

Farm Size & % of Household Income from Farming

Size of Farm (ha)	≤25%	% of Farms	26% - 50%	% of Farms	51% - 75%	% of Farms	≥76%	% of Farms
<1	11,511	40.3	4,377	15.3	4,698	16.4	7,978	27.9
1 – 5	4,099	30.9	4,463	34.7	5,397	45.0	11,154	89.2
5 – 10	754	10.9	1,003	14.5	1,516	21.9	3,642	52.7
10 - 20	502	16.5	476	15.7	671	22.1	1,391	45.7
20 - 50	139	14.1	175	17.7	193	19.5	483	48.7
50 - 100	39	13.6	33	11.5	83	29.4	130	45.5
>100	13	10.3	12	9.5	32	25.4	69	54.8
Total	17,057	26.2	10,539	16.2	12,590	19.4	24,847	38.2

Source: National Agriculture Census 2009

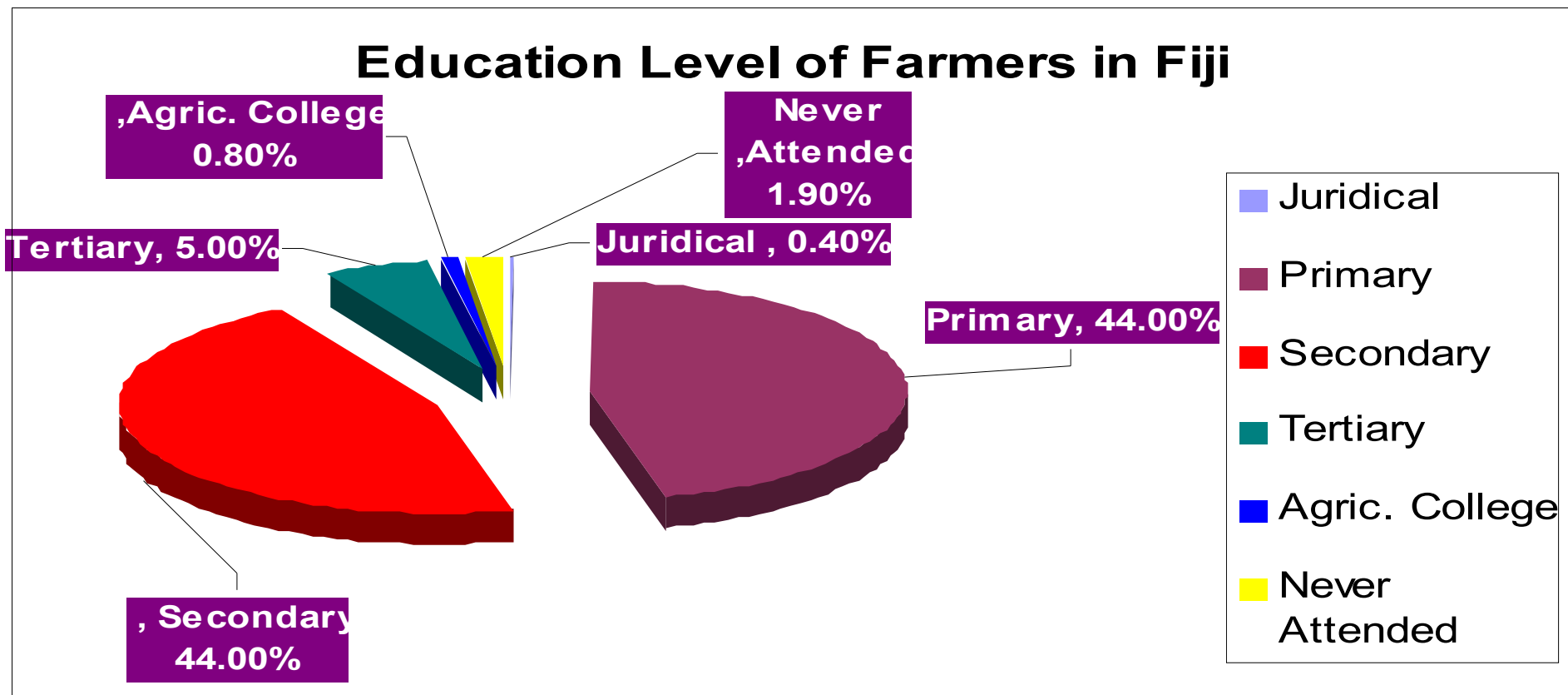


6.5 HUMAN CAPITAL (CONT...)

- Education, intellectual skills, aptitude, health, age and gender and physical capacity for labour have some relationship to technology adoption in Fiji.
- Farmers with higher education possess higher abilities and are able to adjust faster to farm and market conditions and contact the extension service for information.
- Some technologies in rice are management incentives that draw on farmer's education level, intellectual skills and aptitude for learning and assessing new technologies.
- Farmer who has been growing rice for number of years is likely to be more knowledgeable about the patterns of rainfall, the incidence of pest and diseases, and other agronomic conditions of the area than a farmer who is just come into rice farming irrespective of their level of education in Fiji.
- Most farmers are applying a low level of technology and input because of lack of knowledge and economic reasons in Fiji.



6.5 HUMAN CAPITAL (CONT...)



Source: National Agriculture Census 2009



6.5.1 LABOUR AVAILABILITY

- Labour constitutes the most important input into agricultural production in Fiji. Thus, any constraints to the cost and availability of labour is also detrimental to farm productivity.
- Labour can be sourced from family, hired or group labour in Fiji.
- Family labour that can be engaged by rice farmers will depend on the household size, the age structure and primary occupation of the household members. Farmers rely on household members for supply of 80% labour. The average household size is 4.75.
- Factors such urbanization, general increase in price level, rural-urban migration and industrialization tend to have a negative impact on the availability and cost of hired labour in Fiji.
- Younger generations in Fiji are moving away from agriculture in general, and backbreaking rice farming in particular.
- Adoption depends on whether the technology is labour-using (like HYV's) or labour-saving (like bullock or small machine cultivation)
- Also depends on what the bottlenecks are - e.g., like labour scarcity facilities animal and machinery adoption, non-adoption of labour intensive technology where family labour is scare (Central & Western Division), and adoption of labour intensive HYV rice in labour abundant (partly Northern Division) in Fiji.



6.5.1 LABOUR AVAILABILITY

Farm Labour at Divisional Level in Fiji

Division	Farms	% of Farms	Total Workers	% of Workers
Central	16,791	26.1	64,486	29.9
Western	21,406	32.9	72,551	33.7
Northern	19,643	30.2	65,359	30.3
Eastern	7,014	10.8	13,040	6.1
Total	65,033		215,436	



Source: National Agriculture Census 2009

6.5.2 AGING OF FARMERS

- Most of the farm operations in rice cultivation, such as land clearing, tilling, weeding and harvesting, requires a lot of strength and energy.
- Only those farmers within the productive age group of 20 – 45 years are likely to possess the necessary strength to carry out these operations.
- The younger generation in Fiji moving into rice farming is relatively small and less committed to rice industry. They move into the industry either due to lack of any alternative employment.
- The result is that only the old generation is staying with rice farming, which has manifold implications. This also raises a serious socio-political issue.
- In Fiji, 65.5% of the farmers are from 40 to and over 60 years old . Older farmers, unable to take advantage of new technologies that are adopted by younger and more active farmers. They do not believe new technology and only believe their own experience.
- Old behavior of cultivation practices embedded in farmers for long period are not persuaded to use new technology. They only practiced by their own practical such as using traditional varieties, inappropriate fertilizers, plant spacing etc.
- The importance of age lies in its effect on the adoption of innovations and the processing of information. It is well known that, in general, the older the farmer, the less is their willingness.



6.7 AGING OF FARMERS (CONT...)

Size of the Farm and % Age Group

Size of Farm (ha)	% 10 – 19 Yrs	% 20 – 39 Yrs	% 40 – 59 Yrs	% > 60 Yrs
<1	1.1	37.8	45.1	15.8
1 – 5	1.9	64.3	99.5	34.0
5 – 10	0.5	21.1	57.3	21.0
10 - 20	0.3	17.9	51.5	27.6
20 - 50	0.6	27.3	51.0	19.4
50 - 100	0	10.9	62.7	21.1
>100	0	15.9	46.0	30.2
Total	1.0	33.2	48.4	17.1



Source: National Agriculture Census 2009

6.10 CREDIT

- Access to credit is an indicator which manifests itself in other factors such as farm size (a farmer can borrow more money against a larger farm than a smaller farm), human capital farmers with more education are better informed about credit practices and can shop around for competitive interest rates, and land tenure (does not own land and cannot borrow against its value).
- Capital is required to finance adoption of many types of new technology (eg., Machineries, bullocks, hybrids, fertilizers, chemicals etc).
- Differential access to credit leads to differential adoption.
- In Fiji, lack of farmers accessibility to financial institution due to their exorbitant financial conditions is one of the challenges for adoption of technology.



6.11 RISK

- All technology adoption decisions carry with them some mixture of subjective risk – such as human tendencies to assume more uncertainty in outcomes from unfamiliar techniques – and objective risks resulting from variations in rainfall, pests, diseases, and timely access to critical inputs.
- Farmers' individual risk preferences and their ability to bear the risk of a new and uncertain endeavour is observed pattern of technology adoption in Fiji.
- Farmers are kept from experimenting with new techniques and technologies by the amount of risk they are able to take on, not by the amount of risk they prefer to accept.
- Without some level of assurance that access to future benefits is not at risk, farmers have little incentive to invest their time, labour and capital into technology adoption.
- Farmers who are reluctant to risk will wait longer to adopt.



7.0 CONCLUSION

- The transfer and adoption of technologies can lead to the desired results only if farmers comply with the recommendations and requirements of the technologies.
- The process of technology transfer and adoption, thus, must be seen within a larger framework, which takes into account also the historical and socio-economic context.
- Smallholder farmers need to be at the center of policy so that agricultural research, development and extension services meet the real needs of the small-scale farmer.
- There is also a need for reinforced capacity building and international cooperation on technology transfer and technology sharing.
- There is lack of appropriate mechanism as well as human resources required for this purpose in Fiji.
- It is appropriate to have an appropriate system in place to provide technology assessment in rice production in Fiji and identifying problems with transfer process, adoption and diffusion.



A photograph of a vast, lush green field of rice plants. The foreground is filled with tall, dense rice stalks. In the middle ground, the field continues towards a line of trees and a fence. The background shows more trees and a cloudy sky. The text "THANK YOU & VINAKA VAKA LEVU" is overlaid in the center of the image in a bright yellow, bold, sans-serif font.

THANK YOU & VINAKA
VAKA LEVU