Earliness and the short pod-filling period in mungbean and cowpea served as a mechanism of escaping drought stress in the post-rice environment. A similar observation was made by Paje and del Rosario (1984) who showed that the earliness of bush sitao compared to pole sitao was an adaptive mechanism that allowed flowering before a detrimental level of drought occurred.

Yield was lower in paddy but the difference was only significant in sorghum cv. BTX622 and in corn. Flowering was also delayed but to a non-significant extent.

TABLE 1. Grain yield of eight varieties of legumes and cereals under post-rice and irrigated upland conditions; mean separation (according to parameter) by DMRT at 5%.

Species	Varieties	Grain yield (t/ha)		Days to flowering	
		Post-rice	Upland	Post-rice	Upland
Mungbean	Pag-asa 3	0.35f	0.89def	41fg	36g
	IPB M79 13-60	0.41f	0.88def	40g	37g
Cowpea	Vita 5	0.85def	0.95def	53cd	48d
	Vita 7	0.73def	1.00def	49de	45ef
Sorghum	Sg-5	1.14de	1.39d	50de	49d
	BTX 622	0.97def	2.07c	61ab	56bc
Corn	IPB Var 1	0.43f	4.64a	60ab	49d
	IPB 218	0.48ef	3.65b	56bc	52cd

Considering the yield potential and adaptive mechanism to post-rice condition, mungbean and cowpea were better adapted than corn and sorghum. There were no varietal differences in yield but measured morphological/physiological responses indicate the superiority of mungbean cv. IPB M79 13-60 to cv. Pag-asa 3, cowpea cv. Vita 5 to cv. Vita 7, sorghum cv. Sg-5 to cv. BTX 622 and corn cv. IPB 218 to IPB Var 1. These varietal differences suggest that selection for desirable traits may prove useful for developing crop varieties specifically for post-rice culture.

Paje, M.M. and del Rosario, D.A. 1984. J. Phil. Crop Sci., 9, 117-128.
Zandstra, H.G. and Price, E.C. 1977. IRRI Conf. on Cropping System Research.

The Potential of Chickpea after Rice

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CHICKPEA (*Cicer arietinum* L.) is a subtropical, cool season crop which grows well in a range of climates. In the tropics chickpea is usually planted as a monocrop in the cool, post-rainy season in a receding residual soil moisture situation (Saxena 1984). In many countries in the tropics, it is planted as a second crop after the main rainy season crop (usually rice). This is a common practice in Bangladesh, Burma, parts of India, Nepal and Pakistan (Sind province). In these situations chickpea can be planted either after tillage or as a relay crop with no tillage. The latter practice is more common.

As a relay crop, chickpea seeds are broadcast 10-15 days before the harvest of rice. However, it is possible to sow chickpeas in between paddy stubble either behind the plough or with appropriate seed drills with minimum disturbance to the stubble. It is recommend that 1.5-2 times the normal seed rate be used to compensate for poor germination and death due to collar rot (*Sclerotium rolfsii*).

Several factors are important in ensuring the success of chickpea in rice-based cropping systems:

1. The soil moisture levels at sowing and during the crop growth period are important determinants of crop establishment and yield. Cultivars vary in their ability to germinate under limiting soil moisture conditions, and this character can be bred into high yielding varieties.(Saxena 1984). It is also essential to identify and incorporate drought tolerance.

2. Chickpea following rice has to be sown 30-40 days later than the optimal planting time. Thus, there is a need to identify and breed varieties adapted for late planting. ICRISAT has such a breeding program and a few lines have been identified that have performed well under late planting conditions.

3. Decaying paddy stubble may enhance the incidence of collar rot. Seed treatment with fungicides such as Thiram may reduce the pre-emergence mortality (M.P. Haware, ICRISAT, Patancheru, India, pers. comm.).

4. Pod borer (*Heliothis armigera*) resistance is essential in these situations because the podding period is expected to coincide with high pod borer activity.

5. It is necessary to determine whether *Rhizobium* inoculation is necessary for chickpea, as flooded paddy soils could be hostile for *Rhizobium* survival.

Thus, there seems to be a potential for growing chickpea after rice and a need for breeding varieties more suitable for this purpose.

Saxena, N.P. 1984. Chickpea. In: Goldsworthy, P.R. and Fisher, N.M., ed., The Physiology of Tropical Field Crops, John Wiley and Sons Ltd, 419–452.

Irrigated Food Legume Production in Northwestern Australia

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THE aim of the Ord River Irrigation Area (ORIA) in northwestern Australia (120°E–15°S) is to develop modern, mechanised, irrigated farming in Australia's semi-arid (annual monsoonal rainfall of 750 mm) tropics. The scheme is based on private farms on three soil types: clays (12 500 ha), river levees (300 ha), and irrigated sands (700 ha). Large areas are available for further development e.g. 65 000 ha of clay soils.

There are many difficulties in farming the area including: small local markets; remoteness from supplies, markets, population centres and services; poorly developed infrastructure; limited expertise and local experience; high freight charges and limited supply; plus the present low commodity prices. The area also has some advantages: it is close to Asian and small local markets and is the closest supplier of summer crops to West Australia; it has year round frost free production creating a high productivity environment; land prices are low and there is no limitation on water availability; many tropical crops can be grown here that are not suited to other Australian agricultural regions. Advantages of food and feed legumes in this situation include: usually high value per unit weight; good markets; little if any N fertiliser requirements; and in some cases, off-season production and perennial growth.

TABLE 1. Parameters associated with legume crops undergoing expansion.

Crop	Green vegetable bean	Peanut	Chickpea
Growth season	Dry	Wet/dry?	Dry
Past max area	20 ha	330 ha	225 ha
1985–86 area	20 ha	330 ha	225 ha
Av. commercial yield	4 t/ha	2.9 t/ha	1.4 t/ha
Trial yields	13 t/ha	7.0 t/ha	4.5 t/ha
Advantages			
a. Agronomic	Productive cultivars	Well adapted species. Good N fixer nutrient scavenger.	Well adapted cvs. Good N fixer and needs furrow irrigation.
b. Marketing	High value/weight Off season production	High value/wt. Captive local market.	Only Australian source of very large seeded types.
Limitations			
a. Agronomic	High insect pressures	Leaf diseases. Excessive top growth.	Root disease and watering methods.
b. Marketing	Distant from markets	Limited suitable soils.	May be grown elsewhere.
1st commercial prod.	1984	1981	1985
Present research	Commercial operation assessment	Leaf disease control. Improved quality cvs.	Water management. Disease management.

ORIA Effort from the Asian Perspective

1. Direct applicability e.g. the work on soybean establishment and varieties.
2. Future needs. With the population drift to the cities and further development in Asia it is important that mechanised, developed agricultural systems are available for the tropics as well as the temperate areas.
3. Synergistic effects. As tropical products become more available year round, new markets may open up and efficiencies of scale develop.
4. Competition. Competition between ORIA and Asian products may increase.

The problems faced and solutions sought in these climatically similar but culturally different areas demonstrate some similarities, but whether the areas will develop with mutual benefit is unknown.