DIFFERENTIAL EFFICIENCIES UNDER SRI: PRELIMINARY RESULTS FROM RESEARCHER- MANAGED AND WATER- AND LABOUR-ADEQUATE SITUATIONS IN TANJORE DISTRICT, TAMIL NADU STATE, INDIA

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Data sources

- Farmer Participatory Action Research Program (FPARP), Ministry of Water Resources
- Location: Thanjavur district of Tamil Nadu
- Primary data from 2007 Rabi season
- 60 farmers randomly selected:
  - 30 SRI, and
  - 30 Non-SRI

Approach

- **Econometric model**: Stochastic frontier function
- ***Technical efficiency*** is the ability to produce maximum output with a given quantity of inputs. It is the ratio of **actual output** to **maximum possible output**.
- ***Allocative efficiency*** refers to the ability of choosing **optimal input levels** for current output at given factor prices.
- ***Economic efficiency*** is the product of technical and allocative efficiency.

Methodology

Stochastic Frontier

The following equation denotes the production frontier in the matrix form:

$$Y_i = f\,(X\,;\,\beta)\,\exp^{(v_i - u_i)} \qquad ; \qquad i = 1, 2, \ldots\ldots\ldots,n$$

Where:

- Y_i = the output of the i^{th} farm
- X_i = inputs for the i^{th} farm
- β = the vector of parameters to be estimated

- vi = the symmetric component of the error term
- ui = the non-negative random variable which is under the control of the farm

Technical Efficiency

Farm-specific estimates of technical efficiency are defined by:

$$TE_i = E\{\exp(-u_i/\varepsilon_i)\} = \frac{1-\Phi\left[\sigma_{u_i}{}^{*} + \gamma\varepsilon_i/\sigma_{u_i}{}^{*}\right]}{1-\Phi\left[\gamma\varepsilon_i/\sigma_{u_i}{}^{*}\right]}\exp\left(\gamma\varepsilon_i + \frac{1}{2}\sigma_{u_i}{}^{*2}\right)$$

Where Φ is the cumulative function of the standard normal variable

$\sigma_{u_i}{}^{*} = \sqrt{\gamma(1-\gamma)\sigma_{\varepsilon}{}^{2}}$ is an estimated parameter of the conditional distribution u_i/ε_i

Allocative Efficiency

The stochastic cost frontier is given by

$$\ln c_i = C(y_i, w_i; \beta) + v_i + u_i$$

Where:

c_i = the observed cost of production for the i^{th} farm,

C = the deterministic kernel (such as Cobb-Douglas form),

w_i = a vector of prices of input variables,

β = a vector of unknown parameters to be estimated,

v_i = a two-sided error term representing statistical noise, and

u_i = a non-negative cost-inefficiency effect.

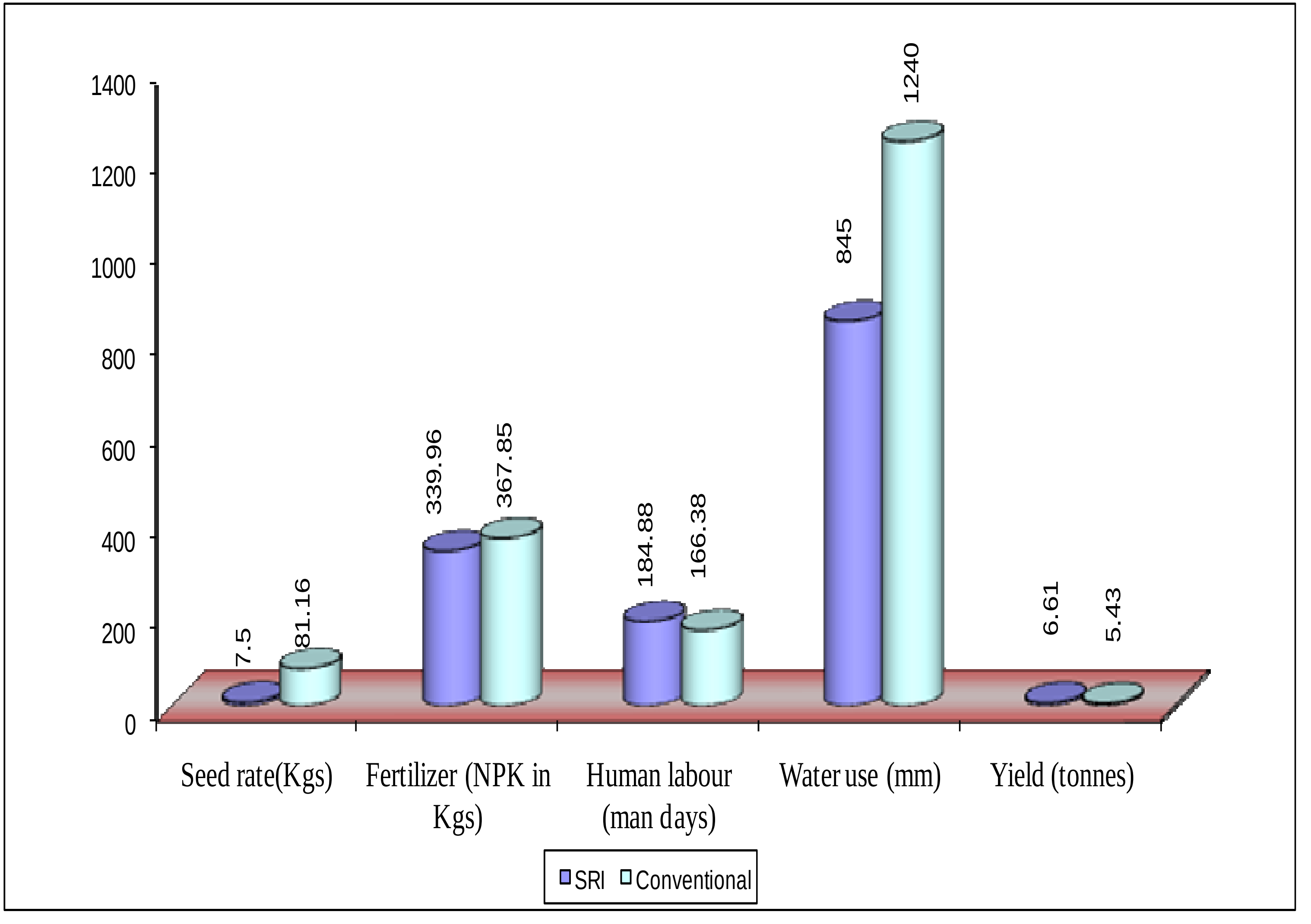
Results and Discussion

Sample mean of resources used (per ha)

Variables	SRI	Conventional	% Difference
Seed rate (kg)	7.5	81.16	-90.8
Fertilizer (NPK in kg)	339.96	367.85	-7.6
Human labour (man-days)	184.88	166.38	+10.8
Water use* (mm)	845	1,240	-32.8
Yield (tons)	6.61	5.43	+21.7

* excluding effective rainfall

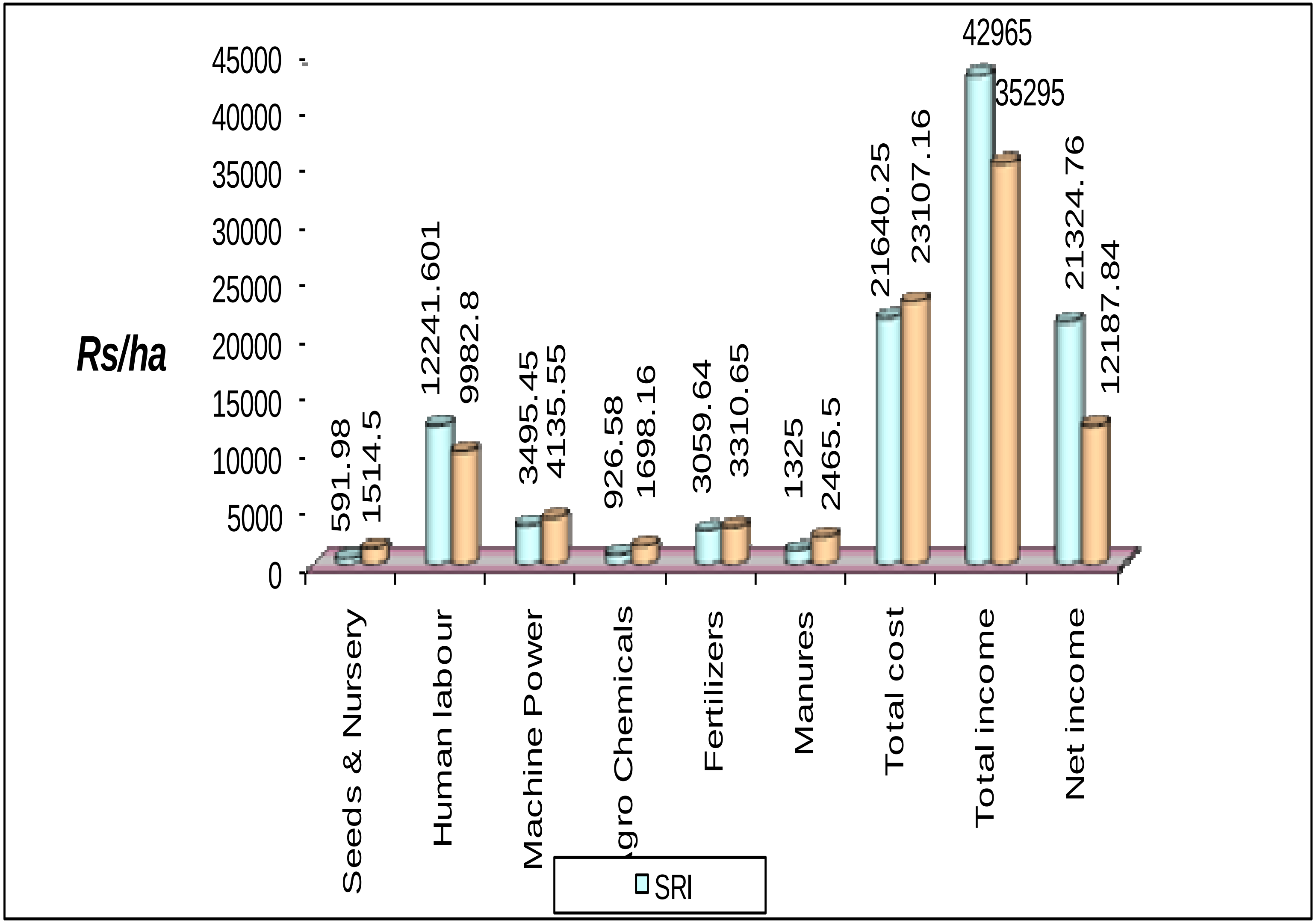
Sample mean of resources used (per ha basis)



Economics of rice production (Rs. per ha)

Particulars	SRI	Conventional	% difference
Seeds & nursery	592	1,515	- 60.9
Human labour	12,242	9,983	+22.6
Machine power	3,495	4,136	- 15.5
Agro chemicals	927	1,698	- 45.0
Fertilizers	3,060	3,311	- 7.6
Manures	1,325	2,466	- 46.3
Total cost	21,640	23,107	- 6.4
Total income	42,965	35,295	+21.7
Net income	21,325	12,188	+75.0

Economics of rice production

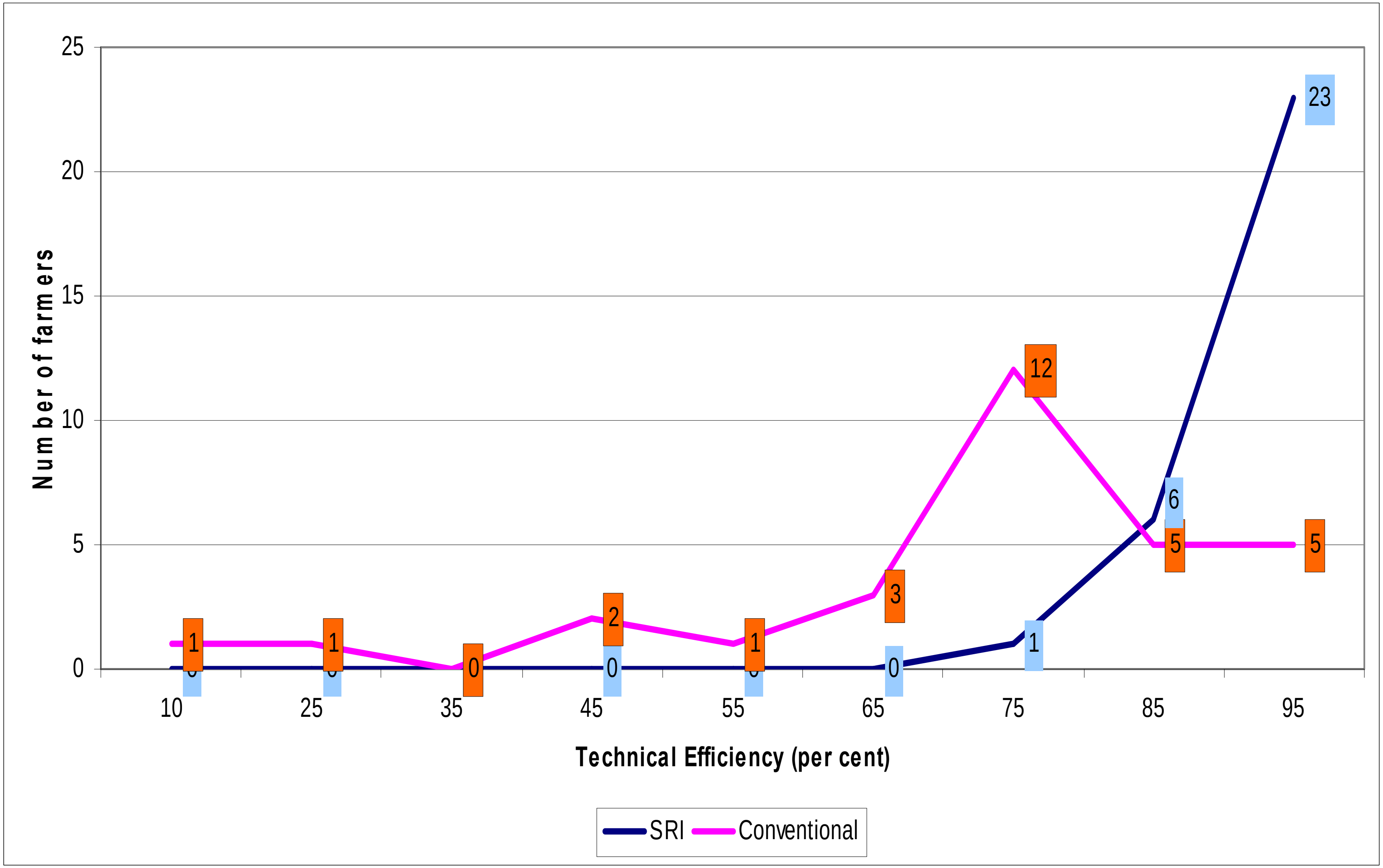


Distribution of technical, allocative & economic efficiencies

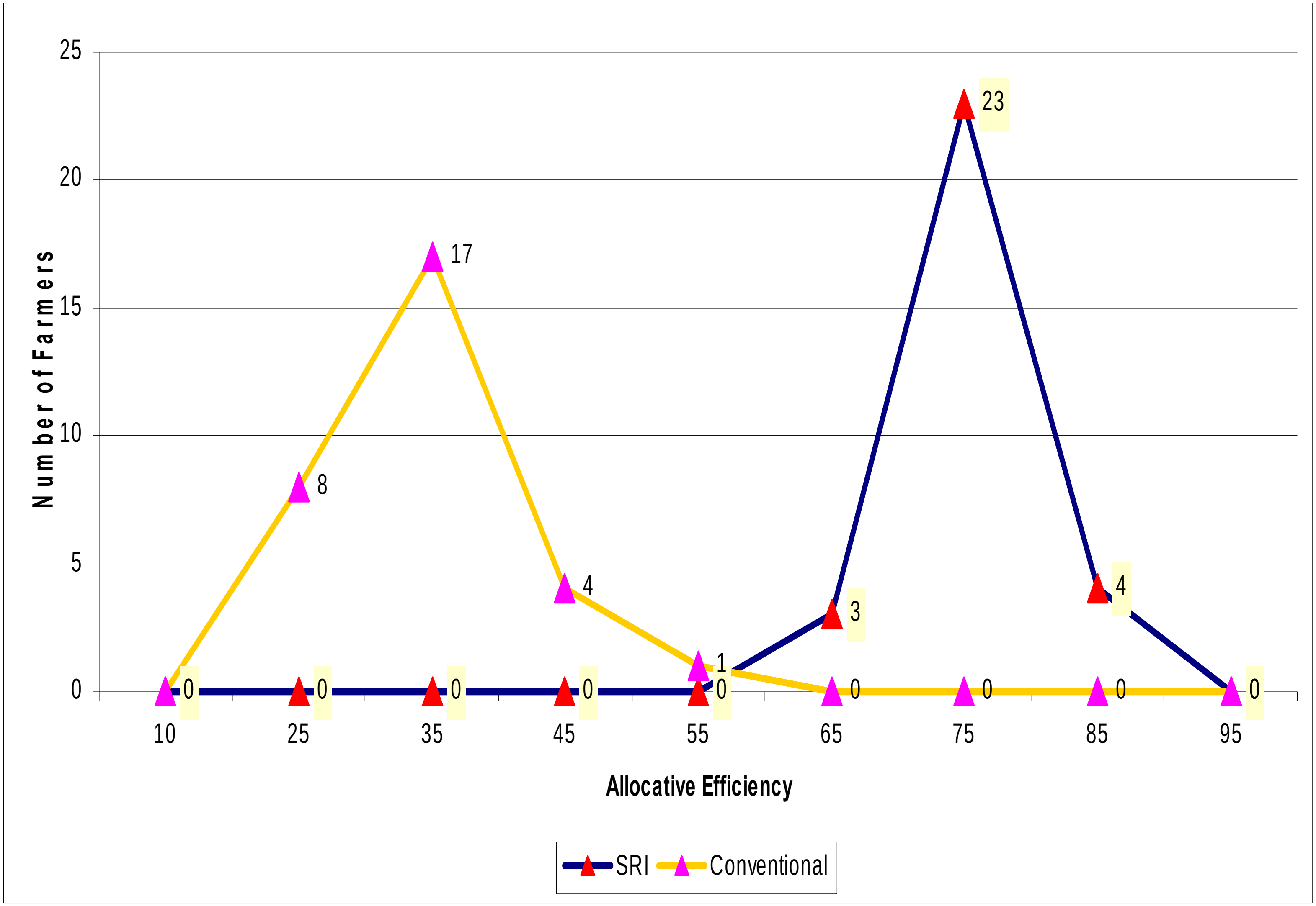
Efficiency (%)	SRI			Conventional		
	Technical efficiency	Allocative efficiency	Economic efficiency	Technical efficiency	Allocative efficiency	Economic efficiency
0 to 19	**-**	**-**	**-**	**1 (3)**	**-**	**7 (23)**
20-29	**-**	**-**	**-**	**1 (3)**	**8 (27)**	**15 (50)**
30-39	**-**	**-**	**-**	**0 (0)**	**17 (57)**	**8 (27)**
40-49	**-**	**-**	**-**	**2 (7)**	**4 (13)**	**-**
50-59	**-**	**-**	**2 (7)**	**1 (3)**	**1 (3)**	**-**
60-69		**3 (10)**	**9 (30)**	**3 (10)**	**-**	**-**
70-79	**1 (3)**	**23 (77)**	**18 (60)**	**12 (40)**	**-**	**-**
80-90	**6 (20)**	**4 (13)**	**1 (3)**	**5 (17)**	**-**	**-**
90-95	**20 (67)**	**-**	**-**	**2 (7)**	**-**	**-**
>95	**3 (10)**	**-**	**-**	**3 (10)**	**0**	**-**
Total	**30 (100)**	**30 (100)**	**30 (100)**	**30 (100)**	**30 (100)**	**30 (100)**
Mean (%)	**92**	**76**	**70**	**73**	**35**	**25**
Minimum (%)	**73**	**67**	**56**	**10**	**26**	**5**
Maximum (%)	**98**	**85**	**82**	**99**	**51**	**37**

Figures in parenthesis denote the percentage to the total number of farmers

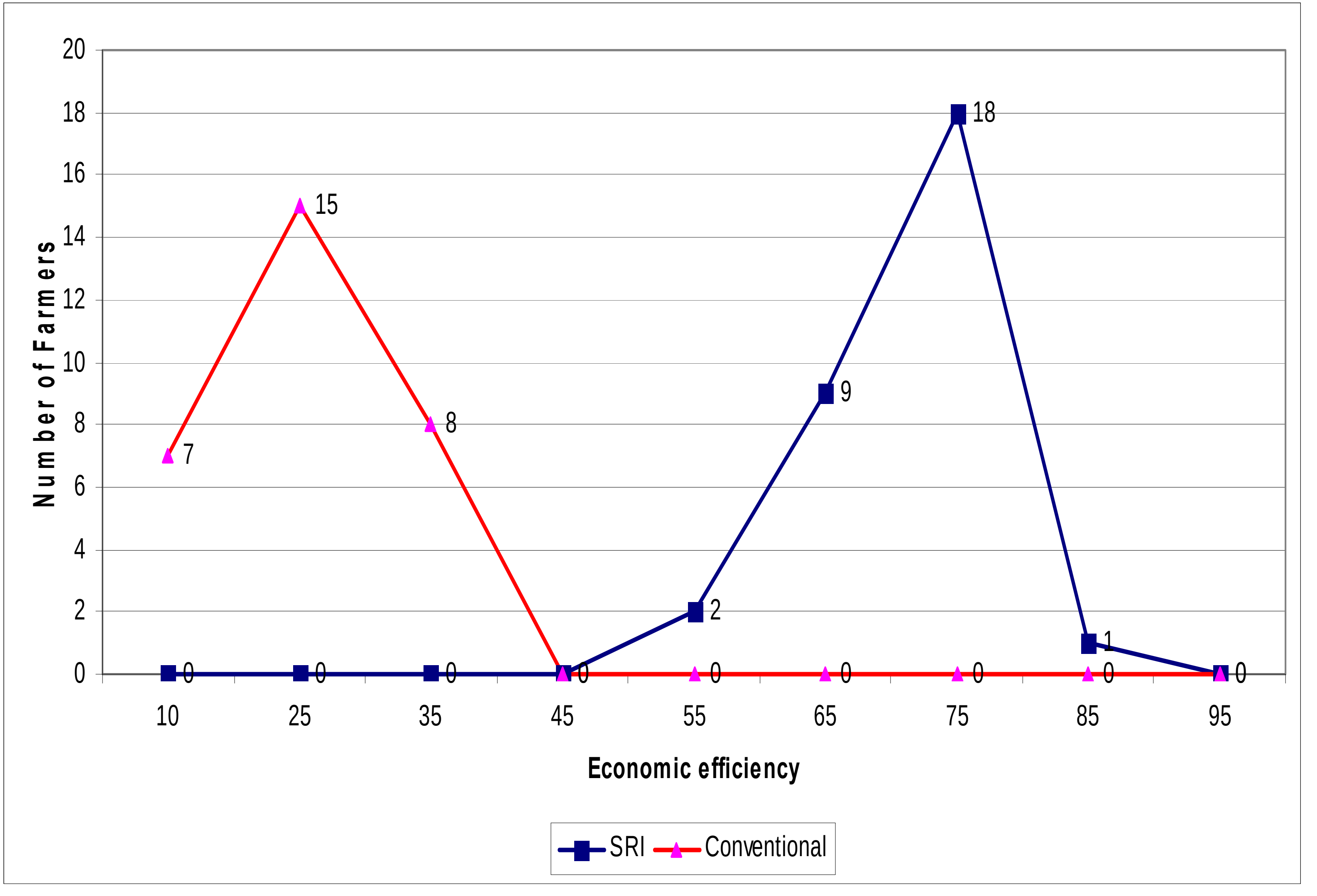
Distribution of Technical Efficiency



Distribution of Allocative Efficiency



Distribution of Economic Efficiency



Conclusion

- ➢ SRI farms are comparatively more efficient
- ➢ Cost reductions are not significant
- ➢ Increased yield primarily makes SRI attractive
- ➢ Sustained yield & prices will decide the future of SRI
- ➢ More studies are needed on:
  - Cost reductions aspects
  - Sustainability aspects

Thank You All