



Production practices and performance attributes of highland rice cultivars along an altitude gradient, Nepal

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Background

- Rice can be cultivated from 60 to 3050 masl altitude in Nepal and plays crucial role in food security of Nepal.
- However, growing rice in Nepalese highlands is not easy due to-High UV radiation, Low night temperatures, Erratic rainfall.
- Jumli Marshi (JM) – a local landrace, is highly preferred due to its quality (taste, color, and nutritional value), although it has low yield and highly susceptible to blast diseases.
- Recently, Nepal Agricultural Research Council (NARC) has developed new improved varieties, namely Jumli Marshi 18, JM20 and JM22.
- Since very limited research had been done in highland rice cultivation, the adaptation and performance of different rice cultivars in different altitude are yet unknown.

Hypothesis

- Variations in altitude lead to changes in climatic conditions and agronomic management practices.
- The change in altitude gradients and management practices differentially influence the adaptation and performance attributes of different rice genotypes.

Results

Site	% of respondent growing		Rice establishment date	
	Jumli Marshi/DBB	Chandanath	Seed sowing	Transplanting
Chumchaur	100%	0%	18-Mar	14-30 May
Sinja	100%	0%	25-Mar	27-30 May
Bijayanagar	47%	53%	25-Mar	25 May-7 June
Tatopani	90%	3%	25-28 March	27 May-7 June

Table 1: Rice varieties grown by farmers (left) and nursery establishment time at different altitudes in Jumla (right). Sample size (n) =78.



Figure 4: A farmer in Tatopani ploughing his field for rice transplanting in the month of June.

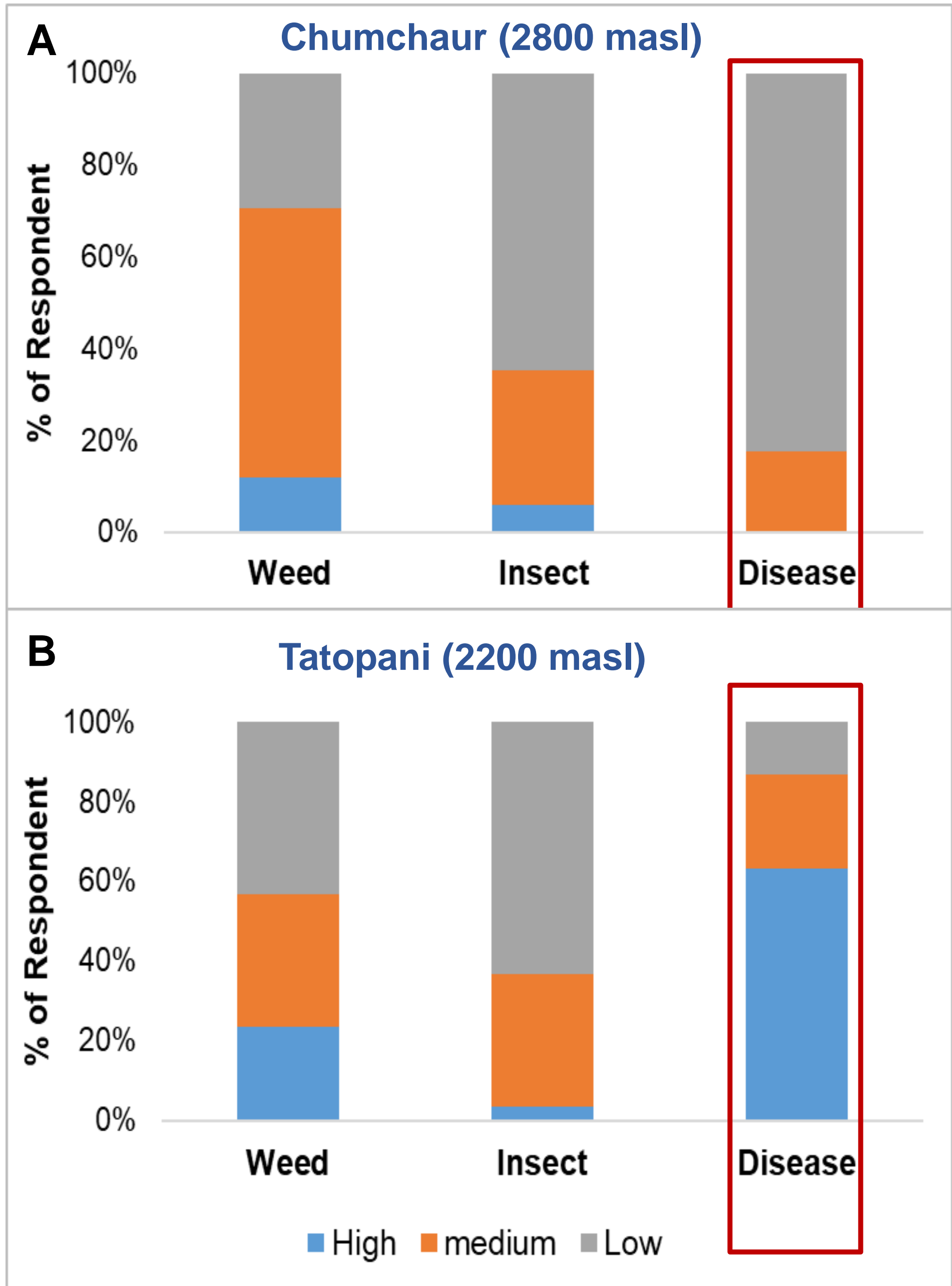


Figure 5: Percentage of respondent perceiving weed, insect and disease as low, medium and high severity at Chumchaur (A) and Tatopani (B) sites. The severity of weed, insect, and disease incidence was assessed on a scale from 0 to 3, where 0 = none, 1 = low, 2 = medium, and 3 = high. In the figure, blue denotes high severity, orange represents medium severity and gray indicates low severity.



Figure 1: Field experimental design, 6 rice genotypes with 3 replications (Tatopani, Jumla)



Figure 2: Jumli Marshi and its derivatives (Jumli Marshi 18, Jumli Marshi 20 and Jumli Marshi 22) used for field experiments.

Conclusion and Outlook

- ✓ Farmers are shifting to earlier dates for rice nursery establishment and transplanting in higher altitudes.
- ✓ Problem of disease is lower in higher altitude.
- ✓ JM and its derivatives showed similar adaptive traits (except in yield).
- ✓ DBB has exceptional increase in yield and showed its strong potential for high-altitude rice breeding and research programs in the future.

Materials and Methods

Household survey – 78 farmers were interviewed in Jumla.

Field trials – With 6 rice genotypes in 5 different altitude locations

Rice genotypes :

- Jumli Marshi (JM)
- Jumli Marshi 18 (JM18)
- Jumli Marshi 20 (JM 20)
- Jumli Marshi 22 (JM 22)
- Chandanath 1 (CH 1)
- Mehele Dhan (DBB)

Research locations :

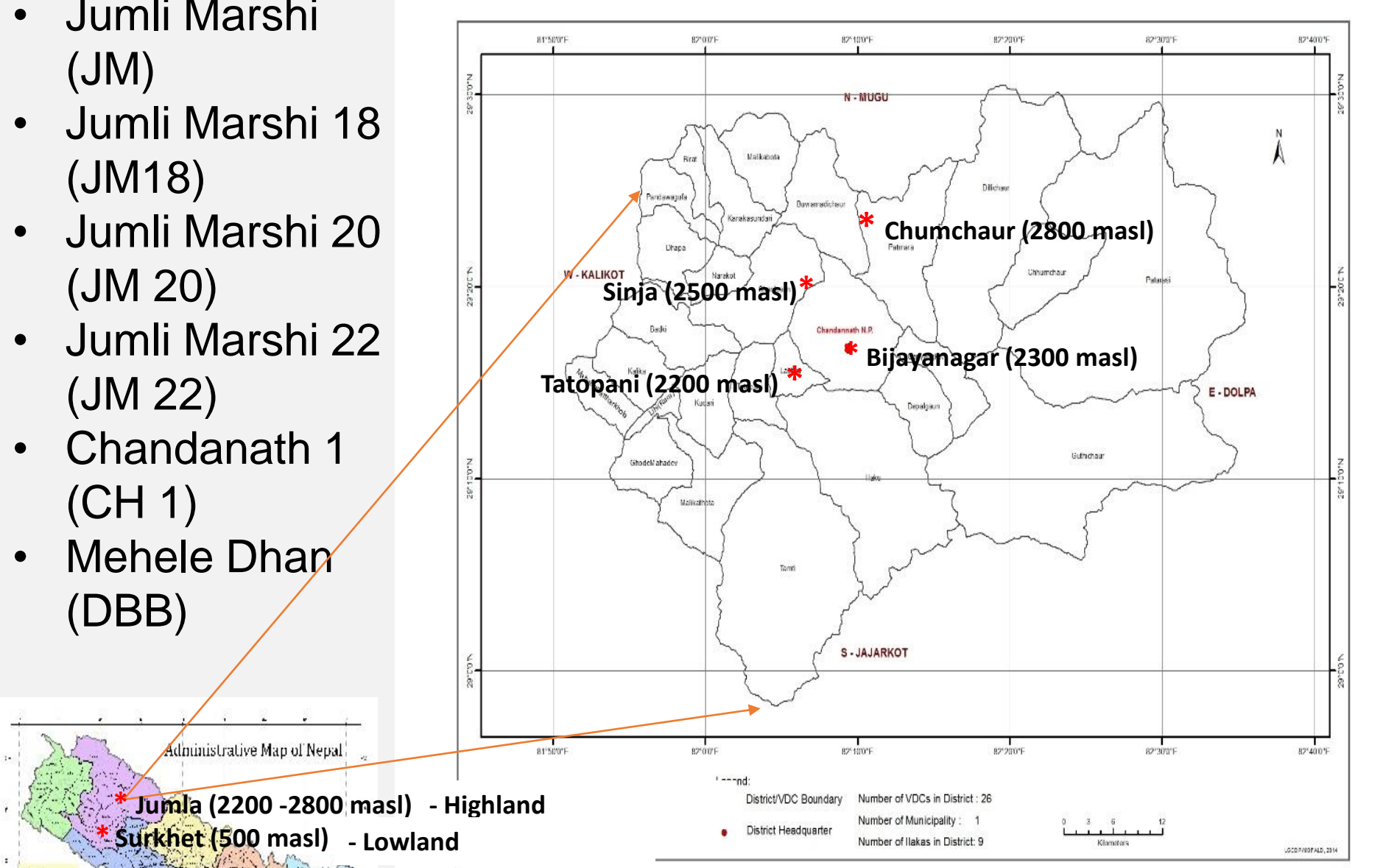


Figure 3: Map showing 5 research locations with altitude in Surkhet and in Jumla districts of Nepal.

- Randomized design
- 3 replications at each altitude
- Flooded irrigation
- Fertilizer : At the time of transplanting (125 g Urea + 195 g DAP) 25 days after transplanting (125 g Urea)

Results

Site		Chl.	NBI	Flav.	Anth.
		(µg cm ⁻²)	index	Index	index
Chumchaur	(n=165)	53 b	57 c	0.94 a	0.04 b
Sinja	(n=196)	60 a	77 a	0.79 e	0.03 c
Bijayanagar	(n=176)	39 c	43 d	0.90 b	0.05 a
Tatopani	(n=178)	59 a	69 b	0.86 c	0.04 b
Surkhet	(n=108)	31 d	36 e	0.83 d	0.04 b

Genotype		Chl.	NBI	Flav.	Anth.
JM	(n=137)	48 ab	55 c	0.88 a	0.04
JM18	(n=140)	49 ab	56 bc	0.88 a	0.04
JM20	(n=137)	48 b	55 c	0.88 a	0.04
JM22	(n=149)	53 a	61 abc	0.88 a	0.04
CH1	(n=145)	51 ab	62 ab	0.82 b	0.04
DBB	(n=115)	53 ab	64 a	0.84 b	0.04

Table 2: Rice leaf physiological traits and indices. Chl.= Chlorophyll, NBI= Nitrogen Balance Index, Flav. = Flavonoid, Anth. = Anthocyanin, n=sample size. Data are mean values. Different letters denote significance at p <0.05 (LSD test).

- Rice plants in Surkhet (500 masl) did not reach maturity.
- JM and its derivatives showed similar adaptional response.

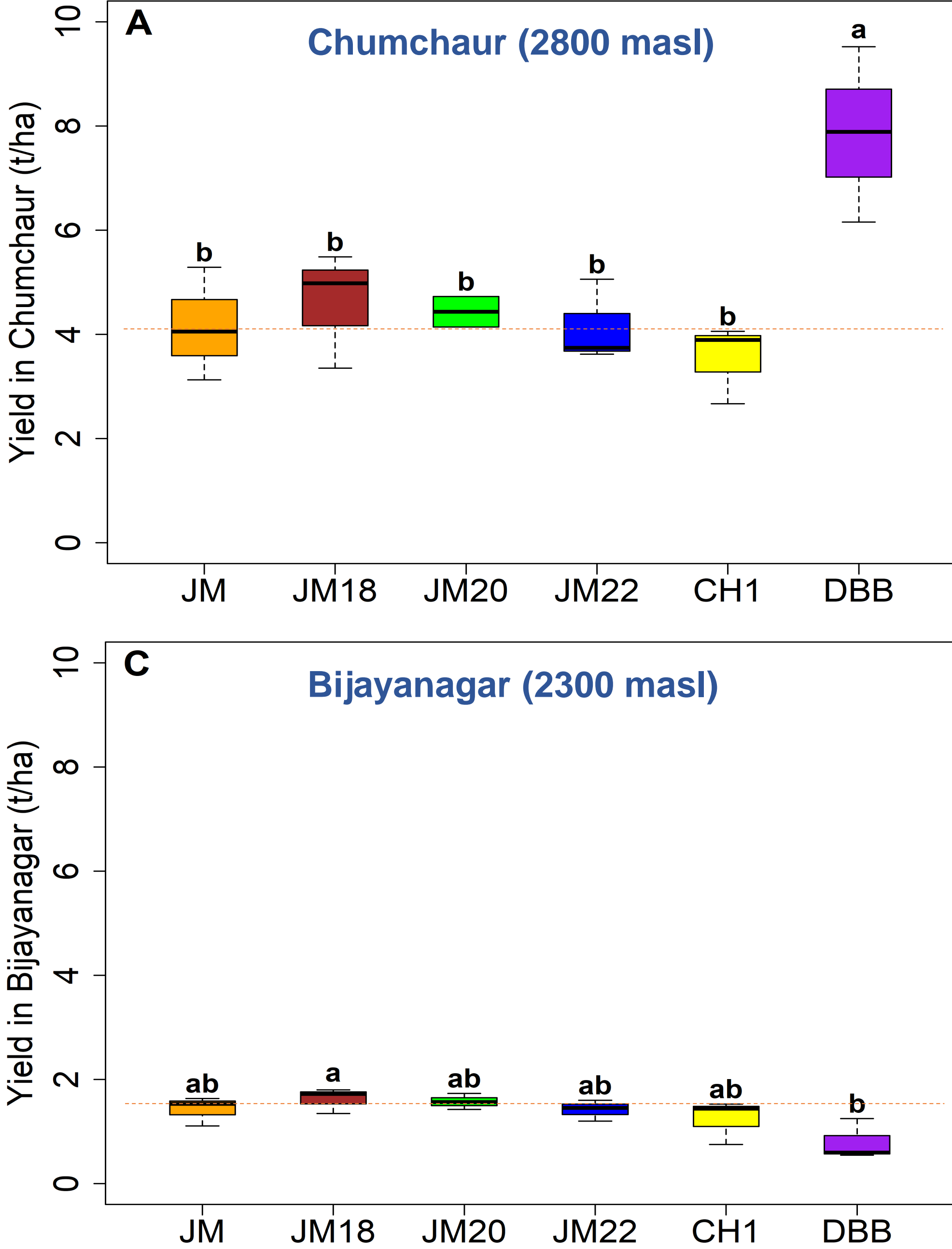


Figure 6: Rice grain yields at Chumchaur (A), Sinja (B), Bijayanagar (C) and Tatopani (D). The dotted line compares the average yield of Jumli Marshi with other genotypes. Different letters denote significance different at p <0.05 (LSD test).