



## Theme 1 Status and trends of global soil nutrient budget

# Profitability of Pure vs. Integrated Application of Organic and Inorganic Nitrogen Fertilizers under Rice-Wheat System

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### ABSTRACT

In the rice-wheat cropping system (RWS), inorganic N fertilizers application is the largest component and the use of organic fertilizers is ignored.

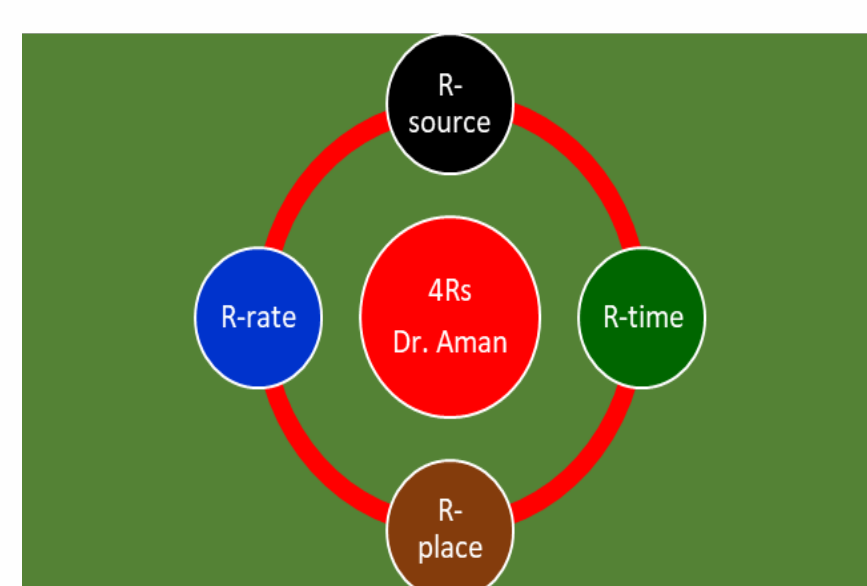
The main objective of this study was to investigate the impact of different pure organic N-fertilizers, ratios of inorganic and organic N-fertilizer, and integration of inorganic plus organic N-fertilizers in various combinations (mixtures) on net returns (NR) and value cost ratio of the current rice crop (CRC), subsequent wheat crop (SWC) and the whole rice-wheat cropping system (RWS).

Field experiments were conducted on the progressive farmer field at Malakand (Batkhela) for two successive years. The result revealed that among the six organic N-fertilizers 2011-12 (Y1) and 2012-13 (Y2). used (three sources each of animal manures: poultry, sheep & cattle manures; and crop residues: onion, wheat & berseem residues); poultry manure (PM) application gave the highest and wheat residues (WR) gave the lowest NR for both CRC and RWS. The NR of all organic sources increased significantly in Y2 than Y1.

The ratio of 75:25 (75% N from urea + 25% N from OS) gave the highest NR in Y1; whereas, the ratio of 50:50 resulted in the highest NR in Y2 for both CRC and RWS. The results also revealed that integrated use of U + PM ranked first in terms of highest NR and U + WR stood in the bottom for both CRC and RWS. In both years, the integrated use of urea plus animal manures performed better than urea plus plant residues.

### CONCLUSION

Profitability (net returns-NR) increased tremendously in N-treated plots (rest) over N-control plots under CRC, SWC and RWS. Among the organic sources, application of poultry manure because of its less C/N ratio (12:1) and lower cost was considered the most beneficial in terms of higher NR. Wheat residue, on the other hand, because of its higher C/N ratio (125:1) and higher cost had the most negative impact on NR. Among the crop residues, berseem and onion residues increased profitability over wheat residues. It was also concluded that integrated use of nitrogen in the form of 50% each from poultry manure and urea (50% U: 50% PM) improved soil fertility, crop productivity and profitability under rice-wheat system.



### METHODOLOGY

Field experiment was conducted to investigate the effect of organic N-fertilizers sources (animal manures and plant residues) and inorganic N-fertilizer (urea) on profitability of hybrid rice (Pukhraj) and their carryover effects on the succeeding wheat (Siren-2010) under rice-wheat cropping system (RWS).

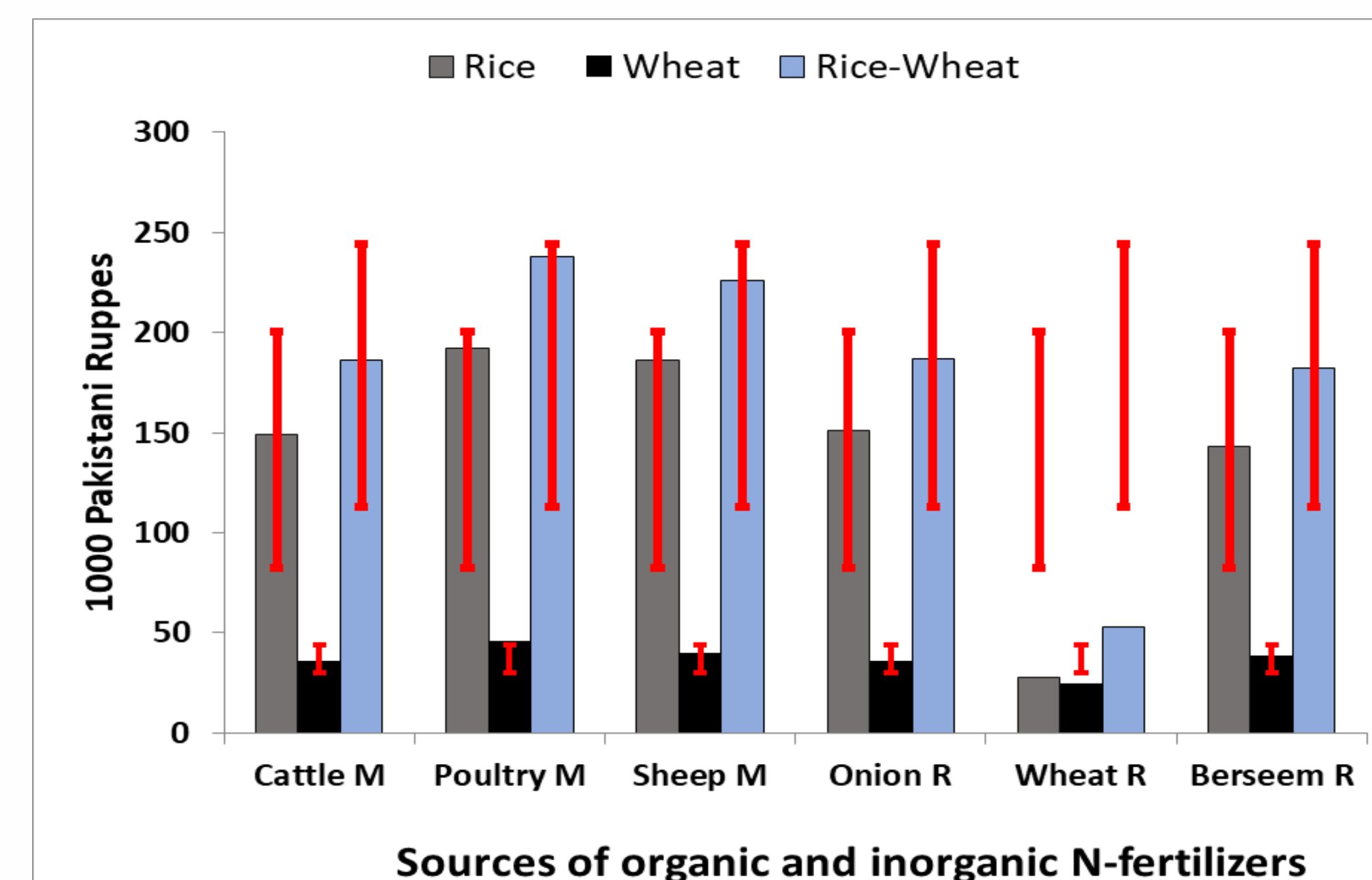
Six different sources of organic sources (OS) used were three animal manures viz. poultry manure (PM), sheep manure (SM) and cattle manure (CM), and three crop residues viz. onion residues (OR), berseem residues (BR) and wheat residues (WS).

The experiments were carried out on progressive farmer's field at Batkhela, Malakand Division (Khyber Pakhtunkhwa, Pakistan) during 2011-12 (Y1) and 2012-13 (Y2). Batkhela is located at 34°37' N and 71°58'17" E. The soil of the experimental field was clay loam, slightly alkaline (pH = 7.3), non-saline (ECe = 1.02 dS/m), moderately calcareous in nature (CaCO<sub>3</sub> = 7.18%), low in soil fertility (containing less organic matter (0.71%), total N (0.51%), extractable P (5.24 mg/kg) and Zn (0.93 mg/kg).

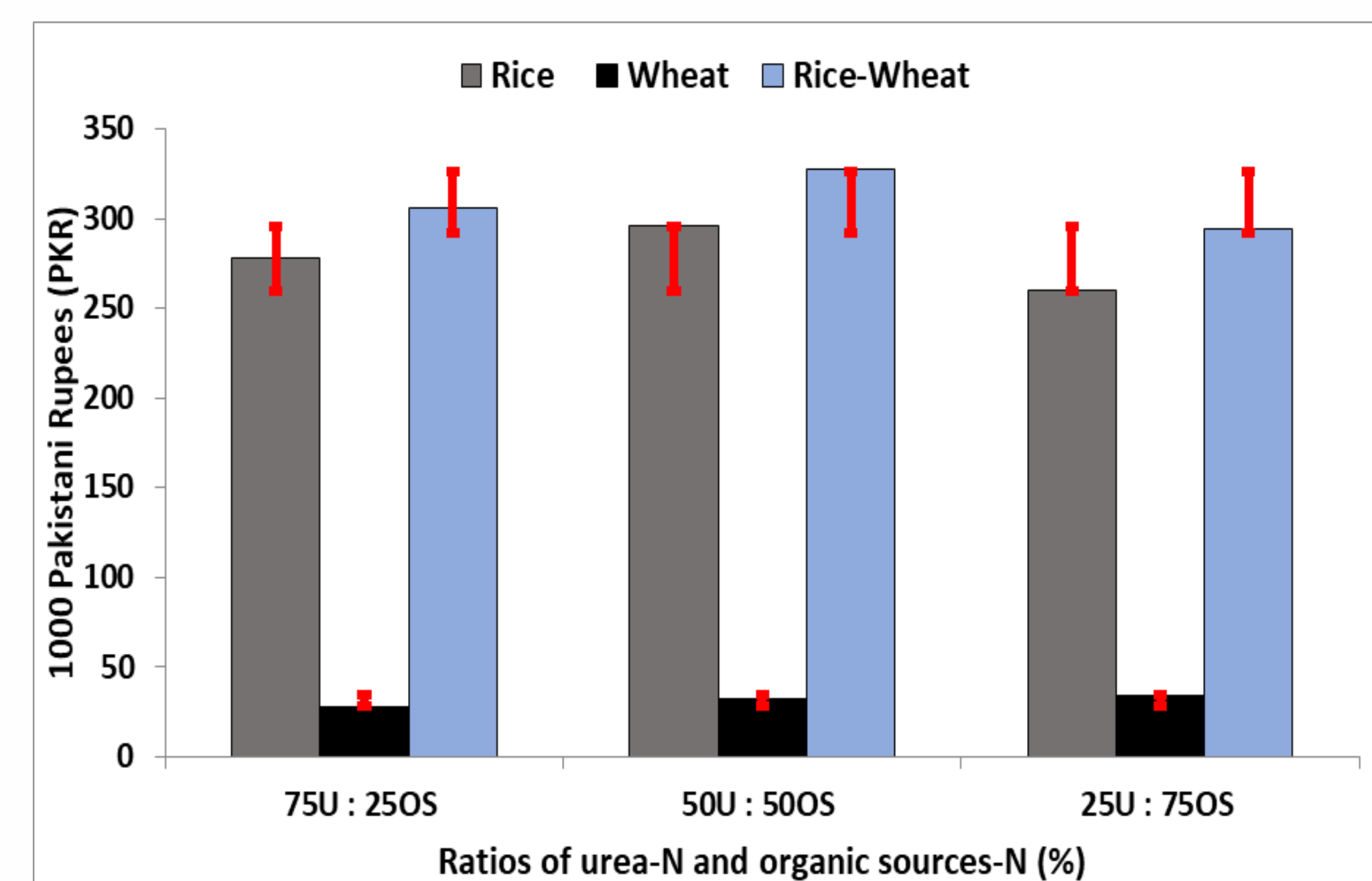
**Table 1. The 26 treatments combination while using various sources and ratios of organic and inorganic N-fertilizers (120 kg N ha<sup>-1</sup>) under rice-wheat system in Northwest Pakistan.**

Treat.	Percent N applied from urea	Percent N applied from organic sources						Total N applied (kg/ha)
		Cattle	Poultry	Sheep	Onion	Wheat	Berseem	
T <sub>1</sub>	0	0	0	0	0	0	0	0
T <sub>2</sub>	100	0	0	0	0	0	0	120
T <sub>3</sub>	75	25	0	0	0	0	0	120
T <sub>4</sub>	75	0	25	0	0	0	0	120
T <sub>5</sub>	75	0	0	25	0	0	0	120
T <sub>6</sub>	75	0	0	0	25	0	0	120
T <sub>7</sub>	75	0	0	0	0	25	0	120
T <sub>8</sub>	75	0	0	0	0	0	25	120
T <sub>9</sub>	50	50	0	0	0	0	0	120
T <sub>10</sub>	50	0	50	0	0	0	0	120
T <sub>11</sub>	50	0	0	50	0	0	0	120
T <sub>12</sub>	50	0	0	0	50	0	0	120
T <sub>13</sub>	50	0	0	0	0	50	0	120
T <sub>14</sub>	50	0	0	0	0	0	50	120
T <sub>15</sub>	25	75	0	0	0	0	0	120
T <sub>16</sub>	25	0	75	0	0	0	0	120
T <sub>17</sub>	25	0	0	75	0	0	0	120
T <sub>18</sub>	25	0	0	0	75	0	0	120
T <sub>19</sub>	25	0	0	0	0	75	0	120
T <sub>20</sub>	25	0	0	0	0	0	75	120
T <sub>21</sub>	0	100	0	0	0	0	0	120
T <sub>22</sub>	0	0	100	0	0	0	0	120
T <sub>23</sub>	0	0	0	100	0	0	0	120
T <sub>24</sub>	0	0	0	0	100	0	0	120
T <sub>25</sub>	0	0	0	0	0	100	0	120
T <sub>26</sub>	0	0	0	0	0	0	100	120

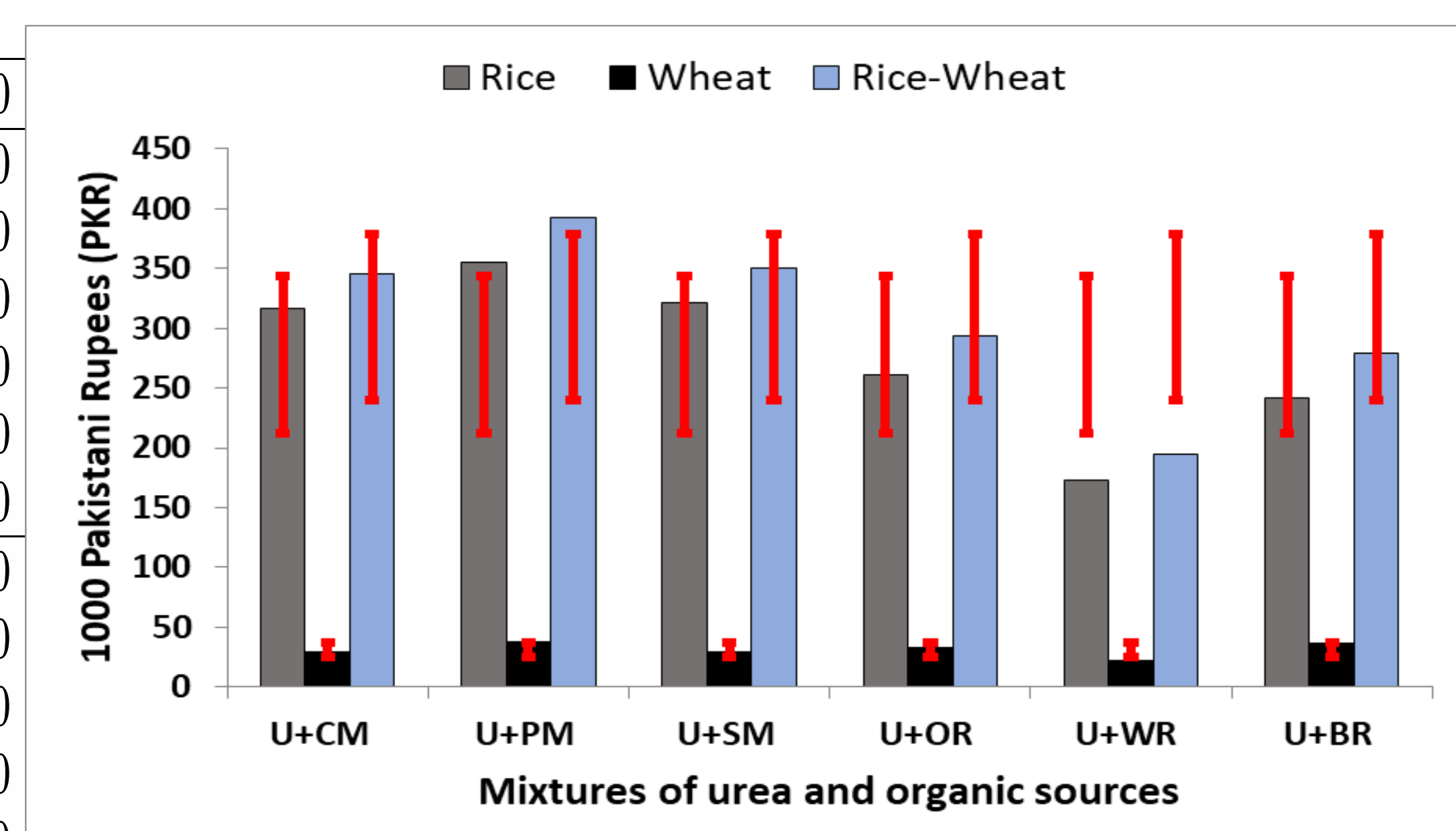
### RESULTS



**Figure 1. Effect of organic sources on profitability under rice-wheat system.**



**Figure 2. Effect of different ratios of urea (U) and organic sources on profitability under rice-wheat system.**



**Figure 3. Effect of integrative use of Urea (U) plus organic sources on profitability under rice-wheat system.**

### REFERENCES

**Amanullah and Hidayatullah. 2016.** Influence of organic and inorganic nitrogen on grain yield and yield components of hybrid rice in Northwestern Pakistan. *Rice Science*. 23(6): 326-333.

**Amanullah; Ullah, H.; Soliman Elshikh, M.; Alwahibi, M.S.; Alkhtani, J.; Muhammad, A.; Khalid, S.; Imran. 2020.** Nitrogen Contents in Soil, Grains, and Straw of Hybrid Rice Differ When Applied with Different Organic Nitrogen Sources. *Agriculture*, 10, 386.



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