Considering the presence of interannual climatic variability and other unstable factors, evaluating the adaptability of transfer models across different years is of great significance. Therefore, the $RF_{transfer}$ model trained solely on 2022 data was independently validated using the 2023 dataset to assess its crop type prediction performance.

The independent validation dataset for 2023 was derived from field survey data collected in the Hexi Corridor region, comprising a total of 455 validation points. Specifically, the dataset includes 143 points for maize, 93 points for alfalfa, 44 points for oats, 60 points for canola, and 115 points for spring wheat. The data collection and preprocessing procedures were consistent with those applied to the 2022 dataset to ensure comparability.

Specifically, two sets of validation experiments were conducted. First, the $RF_{transfer}$ model trained with all available target domain data was transferred to the 2023 dataset for evaluation, and the results are summarized in Table S1. Second, $RF_{transfer}$ models fine-tuned with progressively increasing proportions of target domain data were also transferred to the 2023 dataset for evaluation, with the corresponding results presented in Table S2. The results indicate that the $RF_{transfer}$ model trained on 2022 data maintained good transfer performance when applied to the 2023 dataset.

Table S1. Validation results of the $RF_{transfer}$ model, trained with all target domain data, on the 2023 independent validation dataset.

Model	Overall accuracy	Class-mean recall	Macro f-score	Weighted f-score	Kappa
$RF_{transfer}$	0.9265	0.8043	0.8427	0.9241	0.8791

Table S2. Validation results of $RF_{transfer}$ models progressively trained with increasing target domain data, evaluated on the 2023 independent validation dataset.

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
OA (%)	65.88	87.53	87.4	88.45	89.23	91.21	90.94	91.60	91.60	91.61	92.65
Kappa	0.7166	0.7905	0.7822	0.8048	0.8184	0.8541	0.8491	0.8604	0.8603	0.8611	0.8791

In table the first row of the table represents the gradually increasing proportions of target domain data, where 0% indicates no target domain data was used, and 100% indicates that all target domain data was included.