

## Effects of No-Tillage and Straw Mulching in Wheat on Yield Performance Indicators of Subsequent Maize in Oasis Irrigation Areas: Postprint

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### Abstract

Yield performance is a key factor determining crop growth, development, and yield formation. Investigating the effects of previous crop straw management on subsequent crop yield performance indicators holds important guiding significance for establishing efficient cropping systems and optimizing cultivation practices. From 2009 to 2012, a field fixed-point experiment was conducted in the Hexi Oasis Irrigation Area of Gansu Province to examine the effects of different straw return and tillage measures for previous wheat crop (NTSS: 25 cm high stubble harvest with standing stubble no-tillage; NTS: 25 cm high stubble with equal amount of straw mulching no-tillage; TIS: 25 cm high stubble with equal amount of straw incorporation tillage; CT: conventional tillage control without stubble retention) on yield performance indicators of subsequent maize crop, aiming to provide a basis for optimizing maize planting patterns in the experimental region. The results showed that, compared with CT, previous wheat straw return decreased the Leaf Area Index (LAI) and Leaf Area Duration (LAD) of subsequent maize before the big trumpet stage, but increased LAI and LAD after the silking stage, thereby delaying senescence, with NTSS and NTS exhibiting prominent effects in delaying senescence. The Mean Leaf Area Index (MLAI) during the entire growth period of maize under NTSS, NTS, and TIS treatments increased by 12.8%, 19.1%, and 7.0% compared with CT, respectively, and total Leaf Area Duration increased by 12.9%, 18.6%, and 6.8%, respectively, with no-tillage straw return (NTSS and NTS) demonstrating the best effect in improving MLAI and LAD. No-tillage straw return increased the Mean Net Assimilation Rate (MNAR) during the entire growth period of maize, with NTSS showing a significant increase of 10.7% compared with CT; however, Net Assimilation Rate (NAR) increased before the silking stage but decreased after the silking stage. NTSS and NTS increased the grain yield of subsequent

maize by 13.0% and 15.6% compared with CT, respectively, while TIS increased by 7.9% compared with CT, with NTS showing the greatest yield-enhancing effect. Under different straw return and tillage methods, maize grain yield showed an extremely significant positive correlation with MLAI, Ear Number (EN), and Kernel Number per Ear (KNE), a significant positive correlation with Harvest Index (HI), but no significant correlation with MNAR. The increases in MLAI, EN, and KNE, and the improvement in HI are the main reasons for the increased yield of subsequent maize from previous wheat no-tillage straw return. No-tillage straw return of the previous crop showed the best effect in optimizing main yield performance indicators of subsequent maize. Therefore, 25 cm straw mulching no-tillage return of previous wheat is a feasible cultivation measure for optimizing yield performance indicators and obtaining high yield of subsequent maize in oasis irrigation areas.

## Full Text

### Effect of Wheat Straw Return to Soil with Zero-Tillage on Maize Yield Performance Indicators in Irrigated Oases

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## Abstract

Yield performance is a critical factor determining crop growth, development, and yield formation. Understanding how straw management in previous crops affects the yield performance indicators of subsequent crops provides essential guidance for establishing efficient cropping systems and optimizing cultivation practices. From 2009 to 2012, a field positioning experiment was conducted in the Hexi Oasis Irrigation Region of Gansu Province to investigate the effects of different wheat straw return and tillage methods on the yield performance indicators of subsequent maize crops. The treatments included: NTSS (no-tillage with 25 cm high stubble standing), NTS (no-tillage with 25 cm high stubble mulching), TIS (tillage with 25 cm high stubble incorporation), and CT (conventional tillage without straw return as control). The results demonstrated that compared with CT, wheat straw return reduced leaf area index (LAI) and leaf area duration (LAD) of subsequent maize before the large bell mouth stage, but increased LAI and LAD after silking, thereby delaying senescence, with NTSS and NTS showing the most pronounced effects. The mean leaf area index (MLAI) of maize under NTSS, NTS, and TIS increased by 12.8%, 19.1%, and 7.0%, respectively, while total LAD increased by 12.9%, 18.6%, and 6.8%, respectively, compared with CT. No-tillage straw return (NTSS and NTS) was

most effective in improving MLAI and LAD. No-tillage straw return also enhanced the mean net assimilation rate (MNAR) throughout the growing season, with NTSS showing a significant increase of 10.7% over CT. However, net assimilation rate (NAR) increased before silking but decreased after silking under these treatments. NTSS and NTS increased grain yield of subsequent maize by 13.0% and 15.6%, respectively, compared with CT, while TIS increased yield by 7.9%, with NTS demonstrating the greatest yield-increasing effect. Correlation analysis revealed that grain yield was highly significantly positively correlated with MLAI, ear number (EN), and kernel number per ear (KNE), significantly positively correlated with harvest index (HI), but not significantly correlated with MNAR. The primary reasons for increased maize yield under wheat straw return conditions were the improvements in MLAI, EN, KNE, and HI. No-tillage straw return optimized the main yield performance indicators most effectively. Therefore, returning 25 cm wheat straw through no-tillage mulching represents a feasible cultivation practice for optimizing yield performance indicators and achieving high yields of subsequent maize crops in oasis irrigation regions.

**Keywords:** Maize; No-tillage; Straw return to soil; Succession crop; Yield performance; Irrigated oasis

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## 1 Materials and Methods

### 1.1 Study Area

The experiment was conducted from 2009 to 2012 at the Oasis Agriculture Research and Teaching Base of Gansu Agricultural University (37°30' N, 103°5' E). The experimental site is located at the eastern end of the Hexi Corridor and belongs to a cold temperate arid climate zone, with an average annual temperature of , 0°C and 10°C accumulated temperatures of 3,513.4°C and °C, respectively, and annual sunshine duration of 2,945 hours. The region receives approximately 156 mm of annual rainfall, concentrated mainly from July to September, with annual evaporation of about 2,400 mm, representing a typical oasis irrigation agriculture area. Wheat and maize are the main crops, both cultivated in a one-year, one-crop system. In traditional cultivation, wheat straw is not returned to the field and annual plowing is practiced, while maize is typically grown in continuous cropping with annual plowing and plastic film mulching, leading to increasingly severe continuous cropping pests and diseases and declining yield and quality. The Hexi Oasis Irrigation Region of Gansu is rich in light resources and has suitable heat conditions for maize production, but continuous cropping is widespread with its disadvantages becoming increasingly apparent, and there is a lack of integrated high-yield models for maize that combine rotation with conservation tillage techniques.

## 1.2 Experimental Design

A preliminary experiment was established in 2009 to set up different wheat stubble heights and straw return methods. The experiment was repeated in 2010 and 2012 for data collection and analysis. The maize planting dates were April 22, 2010, and April 20, 2012, with harvest dates of September 28, 2010, and October 2, 2012. The maize variety tested was ‘Wuke 2’. Rainfall during the maize growth period was 94.7 mm in 2010 and 128.5 mm in 2012.

The experiment comprised four tillage and straw return treatments with three replications: (1) NTSS: 25 cm high stubble harvested and left standing with no-tillage; (2) NTS: 25 cm high stubble with equivalent amount of straw mulching under no-tillage; (3) TIS: 25 cm high stubble with equivalent amount of straw incorporation through tillage; and (4) CT: conventional tillage without straw return as control. The straw return amount for NTS and TIS was  $4,200 \text{ kg} \cdot \text{hm}^{-2}$ .

Wheat was planted in 2009 and 2011, with four different harvest methods applied at maturity: NTSS, NTS, TIS, and CT. Maize was planted in the following years (2010 and 2012) to establish a wheat-maize rotation system. Maize planting density was  $82,500 \text{ plants} \cdot \text{hm}^{-2}$ , with plot size of  $48 \text{ m}^2$ .

For CT and TIS treatments, after wheat harvest, the field was plowed (30 cm depth), and in the following spring, basal fertilizer was broadcast before mechanical harrowing and manual film mulching. For NTSS and NTS treatments, after wheat harvest, the field remained untilled; in the following spring, basal fertilizer was broadcast before rotary tillage, harrowing, and manual film mulching. Other field management practices followed local high-yielding field standards. The total nitrogen application was  $450 \text{ kg} \cdot \text{hm}^{-2}$ , applied as basal fertilizer: large bell mouth stage topdressing: grain filling stage topdressing at a 3:6:1 ratio. For topdressing, fertilizer was applied in holes 10 cm from maize stalks at 10 cm depth using a dibble gun and then covered with soil. Phosphorus (P O) was applied at  $225 \text{ kg} \cdot \text{hm}^{-2}$  entirely as basal fertilizer. The irrigation schedule consisted of 120 mm winter irrigation, and 90 mm, 75 mm, 90 mm, 75 mm, and 75 mm at the jointing, large bell mouth, silking, flowering, and grain filling stages, respectively.

## 1.3 Measurements

**1.3.1 Leaf Area Index and Net Assimilation Rate** From maize seedling to maturity stage, five representative plants with uniform growth were selected from each plot using the “S” method at approximately 20-day intervals (specific sampling dates for 2010 and 2012 are shown in Table 1). Leaf length (a) and maximum leaf width (b) of each leaf were measured to calculate leaf area index (LAI). All samples were then oven-dried at  $105^{\circ}\text{C}$  for 1 hour, followed by  $80^{\circ}\text{C}$  for 24 hours to constant weight for dry matter accumulation measurement.

Leaf area index was calculated using the following formula:

$$\text{LAI} = 0.75 \times P \times \sum(a \times b)$$

where 0.75 is a correction coefficient, P is maize planting density, a and b are leaf length and width, respectively, and i is leaf number.

Leaf area duration (LAD) was calculated as:

$$\text{LAD} = \sum(\text{LAI} \times D)$$

where LAI is the mean leaf area index during growth stage i, and D is the duration of stage i.

Net assimilation rate (NAR,  $\text{g} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$ ), representing dry matter increase per unit leaf area per unit time, was calculated as:

$$\text{NAR} = (W_2 - W_1) / (t_2 - t_1) \times (\ln L_2 - \ln L_1) / (L_2 - L_1)$$

where  $L_1$  and  $L_2$  are leaf areas at times  $t_1$  and  $t_2$ , and  $W_1$  and  $W_2$  are dry weights at times  $t_1$  and  $t_2$ , respectively.

Mean leaf area index (MLAI) was calculated according to Zhang et al. [12], and mean net assimilation rate (MNAR) was calculated according to Hou et al. [13].

**1.3.2 Yield and Yield Components** Each plot was harvested separately for yield measurement (excluding sampled plants). Ear number per unit area (EN) was determined, and 10 ears were randomly selected from each plot to measure kernel number per ear (KNE) and 1000-kernel weight (TKW).

## 1.4 Data Analysis

Data were processed using Microsoft Excel 2007 and analyzed using SPSS 17.0 for analysis of variance, significance testing, and correlation analysis.

## 2 Results

### 2.1 Dynamics of Leaf Area Index and Leaf Area Duration of Subsequent Maize Under Different Tillage and Straw Return Methods

**2.1.1 Mean Leaf Area Index (MLAI) and LAI Dynamics** Regarding mean leaf area index across the entire growth period (Table 2), straw return treatments NTSS, NTS, and TIS significantly increased MLAI compared with CT by 11.7%-14.0%, 16.8%-21.5%, and 6.5%-7.4%, respectively ( $P < 0.05$ ). No-tillage straw return (NTSS and NTS) showed greater effects, being 4.9%-6.2% and 9.6%-13.1% higher than TIS, respectively ( $P < 0.05$ ), with NTS demonstrating the most prominent advantage in increasing MLAI.

Previous wheat no-tillage straw return reduced LAI of subsequent maize before the large bell mouth stage but maintained higher LAI after silking (Figure 1 [Figure 1: see original paper]). In both 2010 and 2012, compared with CT, NTSS and NTS significantly reduced LAI before the large bell mouth stage (June 30, 2010; June 27, 2012) by 26.2%-31.1% and 17.8%-30.7%, respectively,

while TIS reduced LAI by 11.2%-13.6% ( $P < 0.05$ ). From large bell mouth to silking stage (June 30–July 20, 2010; June 27–July 17, 2012), NTS was significantly higher than CT by 5.0%-14.3% ( $P < 0.05$ ). After silking (July 20, 2010; July 17, 2012), LAI under NTSS and NTS was significantly higher than CT by 33.5%-41.4%, with TIS being 15.7%-41.4% higher than CT. NTS maintained the highest LAI, being 36.0%-41.4% higher than CT and 17.6%-19.1% higher than TIS ( $P < 0.05$ ), indicating that NTS effectively maintained the photosynthetic source function during the late growth stage.

**2.1.2 Total Leaf Area Duration (LAD) and Its Dynamics** Previous wheat no-tillage straw return significantly increased total LAD of subsequent maize, with NTS showing the most significant effect (Table 2). In both experimental years, total LAD under no-tillage straw return (NTSS and NTS) was 11.2%-14.5% and 16.3%-20.8% higher than CT, respectively, while TIS was 6.0%-7.5% higher than CT ( $P < 0.05$ ). Among the three straw return treatments, NTSS and NTS were significantly higher than TIS by 4.9%-6.6% and 9.7%-12.4%, respectively ( $P < 0.05$ ).

Before the large bell mouth stage (June 30, 2010; June 27, 2012), LAD under NTSS and NTS was lower than CT, with reduction rates of 5.9%-21.4% and 20.1%-23.1%, respectively ( $P < 0.05$ ) (Figure 2 [Figure 2: see original paper]). From large bell mouth to silking stage (June 30–July 20, 2010; June 27–July 17, 2012), LAD under NTSS and TIS was similar to CT, but NTS was 4.9%-14.3% higher than CT ( $P < 0.05$ ). After silking (July 20, 2010; July 17, 2012), LAD under NTSS and NTS was 26.3%-28.1% and 29.7%-33.7% higher than CT, respectively, while TIS was 12.7%-14.0% higher than CT ( $P < 0.05$ ). No-tillage straw return treatments, particularly NTS, showed greater enhancement of LAD, being 15.1%-17.3% higher than TIS. Overall, wheat straw mulching with no-tillage reduced LAD before the large bell mouth stage but increased LAD after silking, with NTS showing the most obvious regulatory effect, laying the foundation for high yield of subsequent maize.

**2.1.3 Dynamic Characteristics of Net Assimilation Rate (NAR)** Previous wheat no-tillage straw return increased NAR during the early growth stage but decreased NAR during the late growth stage of subsequent maize (Figure 3 [Figure 3: see original paper]). The maximum NAR in both years occurred from small bell mouth to silking stage (June 10–July 20, 2010; June 9–July 17, 2012). In 2010, the maximum NAR under tillage treatments TIS and CT appeared earlier than under no-tillage treatments NTSS and NTS, while in 2012, the maximum occurred during the small to large bell mouth stage (June 10–30) for all treatments. NAR during the small to large bell mouth stage (June 10–30, 2010; June 9–27, 2012) varied between years, but CT consistently showed the lowest values. During the large bell mouth to silking stage (June 30–July 20, 2010; June 27–July 17, 2012), NTSS and NTS were 21.0%-31.7% and 38.2%-50.4% higher than TIS and CT, respectively, in 2010, while in 2012, NTSS was 10.2% higher than CT ( $P < 0.05$ ). In summary, before silking (July 20, 2010;

July 17, 2012), NTSS and NTS increased NAR by 12.0%–20.3% and 4.4%–16.8%, respectively, compared with CT, with TIS increasing NAR by 8.0%–9.1% ( $P < 0.05$ ), showing that no-tillage straw return had the most prominent enhancement effect. Conversely, after silking, straw return treatments reduced NAR compared with CT, with NTSS, NTS, and TIS decreasing NAR by 7.0%–8.4%, 11.3%–23.9%, and 6.9%–11.0%, respectively ( $P < 0.05$ ), with NTS showing the greatest reduction.

Mean net assimilation rate (MNAR) across the entire growth season was significantly higher under NTSS than CT, with an increase of 6.4%–15.0% ( $P < 0.05$ ) (Table 2).

## 2.2 Yield Performance and Components of Subsequent Maize Under Different Straw Management Methods

Compared with CT, previous wheat straw return significantly increased grain yield of subsequent maize (Table 3). In both experimental years, NTSS and NTS increased grain yield by 12.0%–13.9% and 13.7%–17.5%, respectively, compared with CT, while TIS increased yield by 4.4%–11.3% ( $P < 0.05$ ), demonstrating that no-tillage straw return had a more obvious yield-increasing effect. NTS produced the highest grain yield, reaching 13,470 kg · hm<sup>2</sup> and 13,247 kg · hm<sup>2</sup>, which was 5.7%–9.0% higher than TIS ( $P < 0.05$ ). These results indicate that returning 25 cm wheat stubble through mulching combined with no-tillage is beneficial for increasing maize grain yield.

Wheat straw return significantly improved ear number per unit area (EN), kernel number per ear (KNE), and 1000-kernel weight (TKW) of subsequent maize (Table 3). Compared with CT, EN under NTSS and NTS increased by 8.7%–12.8% and 18.1%–21.0%, respectively ( $P < 0.05$ ). KNE under NTSS and NTS increased by 60.6%–64.6% and 63.7%–67.8%, respectively, compared with CT, while TIS increased KNE by 41.0%–45.8%. NTS showed the greatest improvement in KNE, being 15.0%–16.1% higher than TIS ( $P < 0.05$ ). TKW under NTSS and NTS increased by 4.2%–7.8% and 8.7%–9.6%, respectively, compared with CT, with NTS showing the greatest effect, being 5.0%–5.6% higher than TIS ( $P < 0.05$ ). Overall, NTS produced the highest yield components among the three straw return treatments, forming the basis for high maize yield.

Previous wheat straw return enhanced the translocation of photosynthates to ears in subsequent maize (Table 3). In both years, HI under NTS was significantly higher than CT, with an increase of 5.4%–8.4% ( $P < 0.05$ ), indicating that 25 cm stubble mulching combined with no-tillage is an appropriate stubble management practice for improving photosynthate translocation in maize.

## 2.3 Correlations Between Grain Yield and Yield Performance Indicators Under Different Tillage and Straw Return Methods

Correlation analysis (Table 4) showed that maize grain yield was highly significantly positively correlated with MLAI, EN, and KNE, significantly positively

correlated with HI and TKW, but not significantly correlated with MNAR. These results indicate that wheat straw return can improve the stability of matter production and dry matter translocation efficiency by increasing leaf area index and harvest index, thereby increasing grain yield. Additionally, grain yield can be enhanced by optimizing tillage practices to increase the positive effects of ear number and kernel number per ear.

### 3 Discussion

#### 3.1 Effects of Previous Wheat No-Tillage Straw Return on Leaf Area Index and Leaf Area Duration of Subsequent Maize

Optimal crop growth and development require suitable soil temperature and moisture, which are closely related to root function, photosynthetic characteristics, and yield formation [14-15]. Regulating soil hydrothermal characteristics through tillage and mulching measures plays a crucial role in crop growth [16]. Leaf area index (LAI) and leaf area duration (LAD) are important quantitative indicators of population structure and essential agronomic parameters for reflecting crop growth status and predicting yield [17]. Creating a rational population structure is vital for increasing crop yield, and appropriate cultivation techniques are important measures for regulating population structure [18]. Expanding the source in the early stage and maintaining a large green leaf area in the late stage are the foundations for high crop yield [19]. This study found that previous no-tillage straw return reduced LAI and LAD of subsequent maize before the large bell mouth stage but maintained higher LAI and LAD after silking, with straw mulching under no-tillage (NTS) showing the most prominent effect. This is because no-tillage straw mulching creates lower temperatures in the early stage that favor root growth but limit aboveground development, resulting in a smaller photosynthetic source [20]. After silking, traditional plastic film mulching causes extremely high soil temperatures in the root zone during the flowering and grain-filling stages [21], combined with excessive water and nutrient consumption in the early stage and insufficient nutrients in the late stage, leading to premature senescence of roots and leaves and a relatively smaller photosynthetic source. In contrast, no-tillage straw return creates suitable soil temperatures in the late stage, and the slower early growth results in less nutrient consumption, achieving a “staggered distribution” of nutrients that meets the nutrient demands for vigorous growth in the late stage, thereby increasing LAI and LAD after silking. This indicates that the yield increase from no-tillage straw return occurs mainly during the late growth stage. Previous studies have found that photosynthetic potential after silking accounts for more than 50% of the total in high-yielding maize [2]. In this study, photosynthetic potential after silking under wheat straw return treatments accounted for 63.1%-70.9% of the total, with NTS showing the highest proportion at 66.7%-70.9%, laying the foundation for maize yield increase, which has been confirmed in previous research [22].

### 3.2 Effects of Previous Wheat No-Tillage Straw Return on Net Assimilation Rate of Subsequent Maize

Net assimilation rate is one of the important indicators for measuring crop photosynthetic capacity. Numerous studies have shown that NAR in maize follows a “double-peak” curve throughout the growth period, with peaks occurring at the large bell mouth stage and grain-filling stage, and a valley at the flowering and pollination stage [23]. Similar conclusions have been drawn from studies using different mulching methods such as plastic film and residue mulching [24]. Additionally, Yao et al. [25] found that NAR reached its peak about 50 days after maize emergence, consistent with our results. Other studies have indicated that the silking stage is the transition period from vegetative to reproductive growth, when plant morphological development is complete and leaf area reaches its maximum, yet NAR is lowest after silking [26]. From the perspective of population leaf development, it is believed that LAI affects NAR changes; when LAI reaches its peak, leaves shade each other and the light-receiving area no longer increases with LAI, resulting in decreased NAR [27]. This study showed that previous wheat no-tillage straw return increased NAR before silking but decreased NAR after silking. This is because optimized tillage practices with wheat straw no-tillage return delayed maize growth and development due to lower early temperatures, while suitable soil temperatures in the late stage resulted in obvious compensatory growth, increased population crowding, reduced photosynthetic rates in middle and lower leaves, and consequently decreased NAR. Another possible reason is that NAR varies with MLAI and is a photosynthetic physiological indicator jointly affected by leaf area and dry matter weight, which is significantly influenced by the external ecological environment. The period from silking to grain filling is the hottest season of the year, with vigorous plant metabolism, high respiratory consumption, and less accumulation, leading to reduced NAR [28].

### 3.3 Effects of Previous Wheat No-Tillage Straw Return on Yield and Performance Indicators of Subsequent Maize

Crop yield is determined by the coordinated compensation among yield performance indicators including mean leaf area index, mean net assimilation rate, ear number per unit area, kernel number per ear, and kernel weight [1]. For cereal crops, coordinated development among these yield performance indicators is the foundation for achieving high yield. The main reason for increased maize yield under traditional plastic film mulching is the increase in kernel number per ear, mainly manifested during the tasseling and ear differentiation stages [29]. Strip sub-soiling tillage can increase ear number, kernel number per ear, 1000-kernel weight, dry matter accumulation, MLAI, and MNAR, achieving high yield in densely planted summer maize through the compensatory mechanism of yield performance parameters [30]. This study found that previous wheat straw return increased ear number, kernel number per ear, and kernel weight of subsequent maize, with no-tillage straw return treatments showing significantly

higher ear number than other treatments, mainly due to increased double-ear rate [31]. This is determined partly by the genetic characteristics of the variety and partly because straw no-tillage return significantly increased soil water content and reduced soil temperature during the flowering and silking stages, laying the foundation for ear formation and grain filling [32]. In contrast, conventional tillage showed lower ear number than straw return treatments, possibly due to lower soil water content and higher soil temperature during the flowering and silking stages [20], which reduced LAI and LAD in the late stage, weakened photosynthetic rates, and consequently decreased ear formation rate. Correlation analysis between grain yield and yield performance indicators showed that no-tillage straw return increased maize yield mainly through improvements in MLAI, ear number, kernel number per ear, and harvest index. The 25 cm straw no-tillage return method can be recommended as a regional high-yield cultivation practice for maize.

## 4 Conclusion

Previous wheat straw no-tillage return reduced LAI and LAD of subsequent maize before the large bell mouth stage but increased LAI and LAD after silking, delaying senescence, with no-tillage straw return treatments (NTSS and NTS) showing the most prominent effects in reducing LAI/LAD before the large bell mouth stage and delaying senescence after silking. Compared with CT, NTSS and NTS increased MLAI and total LAD by 11.7%-14.0% and 16.8%-21.5%, and 11.2%-14.5% and 16.3%-20.8%, respectively, while TIS increased them by 6.5%-7.4% and 6.0%-7.5%, respectively, with NTS showing the greatest improvement in MLAI and total LAD. Previous wheat no-tillage straw return increased NAR during the early growth stage but decreased NAR during the late growth stage of subsequent maize, with NTSS showing the most prominent regulatory effect and increasing MNAR by 6.4%-15.0% over the entire growth season. Previous wheat straw no-tillage return was beneficial for increasing subsequent maize yield, with NTS showing the greatest yield-increasing effect, being 13.7%-17.5% higher than CT and 5.7%-9.0% higher than TIS. The high yield was mainly attributed to improvements in MLAI, ear number, kernel number per ear, and harvest index. Therefore, returning 25 cm wheat straw through no-tillage mulching is a feasible cultivation practice for optimizing yield performance indicators and achieving high yields of subsequent maize in oasis irrigation regions.

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