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On-Farm Evaluation of Improved Barley Production Technology Packages in Jordan

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ABSTRACT

The Mashreq Project's objective for Jordan aimed to increase barley production, in order to support the increasing livestock population and reduce the high grazing pressure on the already degraded rangelands. Crop production technologies developed through on-station trials are ultimately targetted for farmers' fields for a large scale production. Demonstrations on farmers' fields were conducted using a "best-bet package" and one or more components of a recommended package of practices. The data were analysed to evaluate the effect of technology and its components from a farmer's perspective and from the state perspective. Averaged over 70 farms from nine locations and five seasons, the best-bet package increased grain yield 81% over farmer management practices. Fertilizer and improved variety of the 'minimum- input- technology' contributed to yield increases — grain yield by 38% with improved cultivars and by 51% with fertilizer application. Improved cultivars, when fertilized, increased grain yield 106% over the unfertilized landrace. Risk assessment indicated positive yield gain in using the package. Farmers are increasingly accepting the Project technologies in other areas of Jordan and other countries in the Mashreq region. This implies that substantial gains in barley production could be achieved by the use of these technologies in other regions where similar climatic conditions prevails.

KEYWORDS: On-farm trials, Barley production technology, Jordan.

INTRODUCTION

Agricultural land in Jordan is under serious pressure. On one hand, only 4.5% of its 8.921 million ha total area is cultivated, while on the other hand, the demographic pressure with a high population growth rate has resulted in a high and rapidly increasing demand for food, specially cereals, meat and dairy products. This situation has encouraged sheep owners to increase their flocks and farmers have expanded the area planted with barley to meet the high demand for feed. This has been achieved primarily through the cultivation of marginal land or by replacing the fallow in barley areas with continuous barley cropping. The higher livestock population and the cultivation of fragile land seriously threatens natural resources, accelerates rangeland degradation, depletes soil fertility and encourages soil erosion (Jaradat,1988 ; Nabulsi et al.,1993).

Barley is the most common rainfed crop, being grown continuously or the customary barley-fallow rotation is the main feed source for small ruminants. Its yields are low (around 600 kg ha^{-1}) in these areas. The main reasons for this low productivity include traditional farming practices, the low rate of adoption of improved technology, and low and erratic rainfall (Haddad et al.,

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1997; Tutwiler et al., 1997). An objective of Mashreq Project in Jordan is to increase barley production by encouraging farmers to adopt the improved practices through on-farm demonstrations that show the potential of such technologies to increase barley grain and straw yields. The long-term objective is to produce more livestock products at reasonable prices and to reduce feed and livestock imports (Haddad et al., 1997). To improve barley production, extensive research was conducted by the Jordan National Center for Agricultural Research and Technology Transfer (NCARTT) in cooperation with international and regional research centers: International Center for Agricultural Research in the Dry Areas (ICARDA), and University of Jordan, through the Jordan Cooperative Cereal Improvement Project (JCCIP, 1984). Crop production technology is generally developed using on-station trials, but they are aimed to be transfered to much larger target areas, such farmers fields. However, before a technology is transfered, its evaluation on on-farm is essential for its adoptability by the farmers'. With this view-point, the project conducted several experiments on farmers' fields over five growing seasons, and developed a recommended package of practices for the production of barley, the subject matter of the present study, initiated in 1989 in Jordan under the Masreq Project with a cooperative effort between Mashreq countries (Iraq, Jordan, and Syria) and ICARDA with financial support from the United Nations Development Programme (UNDP) and Arab Fund for Economic and Social Development (AFESD).

Methods on design and analysis of on-farm trials are given in Gomez and Gomez (1984). Aspects of experimental design for on-farm fertilizer trials have been discussed by Fielding and Riley (1998). An overview of statistical literature on on-farm research has been given in Riley and Alexander (1997). Influence of site-factor on barley response to fertilizer in on-farm trials in northern Syria have been studied by Jones and Wahbi (1992). We discuss two approaches for evaluating data from on-farm trials. A technology can be assessed from either a farmer perspective or from the state perspective described as follows.

(i) Farmer Perspective Approach: A farmer would be interested in a new technology if it exhibits or results into a comparative advantage over his traditional technology at his farm. Such an advantage could be measured by a difference in productivity between the new and traditional technologies for each farm individually. An assessment of technology (and or its components) could be made by studying the statistical distributional behavior of the farm-wise differences. A farmer could also be averse to the new technology if risk on gain is high, even if gains are large.

(ii) State Perspective Approach: A 'state' normally comprising a large group of farms under its governance would be interested in advocating the new technology if it proves to have comparative advantage on *an average basis* over the traditional one, where the average is taken over the group of farmers. Such an advantage could be measured by comparing the two statistical distributions of productivity generated under the new technology and the traditional technology, and considering them independent, although they may have arisen at the same farms. A *state* would be averse to the new technology if the gain on average is low with high risk.

This paper presents results of two types of barley production technology package demonstration trials from the above perspectives.

Materials and Methods

On-farm demonstrations, conducted between 1989/90 and 1993/94 in the selected areas, characterized by low and erratic rainfall, have barley as the dominant crop, and carry the largest population of small ruminants, were represented by the five sites-- the Governorate of Ramtha, Mafraq in the north, Madaba in the center, and Karak and Showbak (Ma'an) in the south.

General Climate Characteristics

The climate of Jordan is predominantly Mediterranean, characterized by cool, wet winters and hot, dry summers, with short transitional periods of spring and autumn. The yearly variation is very high, especially in areas of low rainfall, where barley is usually grown. The high inter-annual variability of rainfall and its erratic distribution contribute to low productivity of barley.

Two on-farm demonstration trials were conducted: 1) "best-bet package" of practices, were compared with farmer practices in one trial, 2) 'minimum input technology' assessed the input component(s) such as cultivar or fertilizer or both in five trials. We present the results in terms of grain and straw yields, yield gaps due to either or both fertilizer and cultivar. The technology and input components were compared with riskiness for specified target yields and yield gap levels.

Best-bet Package

It consisted of the following components: first plowing with a chisel plow followed by a duck-foot plow; early planting (in dry soil) using a seed drill and at a seed rate of 70 kg ha^{-1}; improved barley cultivars: Rum, Deir Alla 106 or ACSAD 176; fertilization with 10 kg N and 25 kg P_2O_5 at planting followed by 25 kg N /ha at tillering; and weed control by spraying with herbicide. This technology was targeted to farmers who either own machinery or have access to hire them, and was demonstrated in individual farmers' field and in consolidated fields of several neighbouring farmers. The consolidated farmers' demonstrations were found necessary, because small field size was considered as a major factor limiting the use of farm machinery and advanced production practices (EL-Hurani, 1988). The average farm size owned by an individual farmer was 3 ha, while the average size of consolidated farms was 15 ha. The total number of farms over the five years and 9 locations were 70; 26 were demonstrations in consolidated fields and 44 in individual fields (Trial 1, Table 1).

Minimum Input Technology

This type of demonstration is targeted at farmers who do not have access to machinery, and tend to minimize inputs used in barely production due to the risks involved. The trials demonstrated the effects of only improved barley cultivars and fertilizer application. The improved cultivar and the fertilizer rate were the same as in the 'Best-bet-package'. These along with the farmer's cultivar and no-fertilization in a factorial arrangement resulted in four treatment combinations and were evaluated at each farm selected. All other practices in these demonstrations followed traditional farmer's practices. There were five such trials (Trials 2-6, Table 1) which differed in the sense that the Trials 2-4 were conducted to demonstrate the effects of improved variety as well as fertilizer and the Trials 5-6 for the effect of recommended fertility levels over the farmer levels under the farmer traditional cultivars. The number of farms selected varied from 18 to 28 over these trials. The area of each field ranged from 1 to 2 ha, with the area of treatment combination ranging from 0.25 to 0.5 ha.

Statistical Analysis

The data used in this study are collected from the results of the demonstrations that were conducted by the Mashreq project (Mashreq Project Annual Reports). The data were statistically analysed using the farmer as well as the state perspectives, by constructing the following variables for the two technologies:

(1) Best-bet Packages:

State interest :Grain and straw yields under improved and farmer systems.

Farmer interest: Gains in grain and straw yields with recommended practice above that of the farmer practice.

(2) Minimum- input Technology

Let the grain and straw yields under the variety and fertilizer components of the technology be represented as: i) improved variety with fertilizer, ii) improved variety but no fertilizer, iii) farmer variety with fertilizer, and iv) farmer variety and no fertilizer. Grain and straw yield gaps due to variety and fertilization were computed as follows: v) yield gap due to variety = yield under improved variety - yield under farmer variety, both at farmer level of fertilization, vi) yield gap due to fertilizer = yield with fertilization - yield without fertilization, both for farmer variety, and vii) overall yield gap due to fertilizer and variety both = yield of improved variety with fertilization - yield of farmer variety without fertilization.

State perspective would be to compare the distribution of the above (i - iv) and compute mean yield gaps using formulae (v-vii). Under farmer perspective approach, farm-wise yield gaps (v-vii) would be computed and their magnitude assessed.

We used paired t-test (i.e. a single sample t-test on the gains or the yield gaps in the above) to assess statistical significance of the technological effect from farmers' perspective and two sample t-test from the State's perspective, in those cases where normality assumption was tenable. We used a non-parametric method, Kolmogorov- Smirnov two sample test (Rao, 1973) for testing the equality of two distributions with a view to compare medians (as a measure of location of the distribution) when normality was not tenable. The test of normality of distribution of yields or gain or yield gaps were tested using chi-square on fitted frequencies of class intervals obtained from the data. Box-whisker plots were used to exhibit the distributions. Although results have been discussed using above tests for normality and t-tests but the tables of values of the underlying statistics have not been included to economize the space.

We evaluated the amount of risk due to a technology by computing the probability of achieving various fixed target yields or target gains in yield under observed distributions as well as modelled normal distribution and presented as graphs. For a chosen target yield, 'risk' to achieve the target is the probability of getting yield less than the target, and can be computed as the proportion of the number of farmers with yield less than the target yield. In case of fitted normal distribution, it is computed using estimates of the mean and standard deviation of the yield distribution. The 'safety' in achieving a target yield is one minus the risk and thus is the probability of getting yield exceeding the target. All the computations were carried out using GENSTAT 5 (Genstat 5 Committee, 1993). Results are presented for the individual trials.

RESULTS

Best-bet Package

Trial 1: We observed significant seasonal difference (P=0.037) on gain in grain yield and governorate difference (P=0.016) on gain in straw yield (due tables not included).

The test of normality (statistics not shown) indicated a normal distribution of yields and gains in yields, except for gain in straw and grain yield under recommended practice. Therefore, both tests, parametric and non-parametric, were applied. We found significant ($P<0.01$) gain in yields of grain and straw from the farmer perspective as well as from the state perspective. The 95% confidence intervals in the gains were (622, 906) kg ha^{-1} for grain and (1067, 1600) kg ha^{-1} for straw. The distribution of yields and the gains due to technology are tabulated in Table (2) for various geographical regions (northern, central and southern governorate) and rainfall zones characterized by the annual rainfall: <= 250mm, 250-300 mm and > 300 mm. A comparison of the risks in these technologies was evaluated through risk curves (Table 3, Figure 1).

Since the normality of distribution is tenable for some variables and not for others over the trials, we present both expected and observed risks (Figure 1).We have computed a safety value as one minus the risk value. Based on the expected values of the safety, we found that from an individual farmer's perspective, there is 81% safety (probability) of getting more than 250 kg ha^{-1} of gain in grain yield due to recommended technology over the traditional one and 85% safety if such an amount of gain in straw is expected. For a larger amount of the yield gain such as 1000 kg ha^{-1}, the safety values are 34% and 62 % for grain and straw, respectively.

Risks of production in the two technologies were also compared from the State perspective. If 1000 kg ha^{-1} is the target yield expected in grain, then it has 78% safety to be achieved under recommended package while under farmer's package it is only 45%. For a target of 2000 kg ha^{-1}, these values are 35% and 4%, respectively. In the later case, recommended technology is more than six times safer than the farmer's practice. For a target straw yield of 1000 kg ha^{-1} the safety values for the recommended technology is 91% and 74% under the farmers' practice. If 2000 kg ha^{-1} of straw is targeted, then recommended technology is more than twice safer compared to the farmer's practice.

Minimum- input Technology

For the trials 2-6, the yields and yield gaps due to variety, fertilizer and both the input components are given in Tables (3 and 4), respectively.

Trial 2: There was a significant effect ($P<0.01$) of the improved varieties and application of the fertilizers on grain and straw, with no significant interaction. The gap due to variety, 208 kg ha^{-1}, (26%) was smaller than that due to fertilizer 422 kg ha^{-1}, (54%) due to fertilizer for grain; 780 kg ha^{-1} and 1000 kg ha^{-1} respectively for the straw. The total yield gap was estimated as 689 kg ha^{-1} (88%) for grain and 1671 kg ha^{-1} (85%) for straw.

We tested the statistical distribution of the yields under farmers' conditions and improved package on fertilizer application and variety as well as overall yield gaps for normality. We found that the yields are normally distributed, except the gap due to fertilizer application on grain and straw, and due to variety on grain.

From the farmers' perspective, all the three yield gaps are statistically significant ($P<0.05$) (test statistics not shown) as well as from State's perspective. Risks in achieving target yield gaps and target yield levels (from farmer's perspective and from State perspective) were also computed for a few selected target values (data not shown as tables). From farmers' perspective, under the improved variety coupled with fertilizer application, gains of more than 500 kg ha^{-1} can be observed with probability 60% on grain and 89% on straw. From the state's perspective, yield target of 1000 kg ha^{-1} of grain can be produced with a probability of 75% under improved variety with fertilization compared to only 33% of success under farmer's practice. To achieve at least 2000 kg ha^{-1} of straw, such probabilities are 96% under improved inputs compared to 36% under farmer's practice.

Trial 3: There were significant ($P<.001$) effects of the fertilizer application on grain and straw yield (Table 5). On grain yield only, fertilizer had significant effect. Improved variety did not show significant gain over the farmer's variety. There was no significant interaction between variety and fertilizer. Yield's gap due to variety was insignificant (17 kg ha^{-1} or 3%) in grain but significant (525 kg ha^{-1}) in straw. Fertilizer contributions were 185 kg ha^{-1} (36%) and 470 kg ha^{-1} (51%) while overall contribution of both the input components were 233 kg ha^{-1} (45%) and 1173 kg ha^{-1} (128%) in grain and straw yields, respectively.

Statistical distributions of the gaps computed from individual farms were statistically deviating from normality, except for the straw yield under farmers' conditions. Comparing distributions using a non-parametric test was considered appropriate. The Kolmogorov -Smirnov test indicated statistically significant gap in the yield due to variety and fertilizer application, from the State perspective.

Risks of production and getting advantage due to improved varieties and fertilizer were evaluated. From a farmer's perspective, an overall gain of more than 250 kg ha^{-1} of grain can be obtained with a probability of 48% while such chances reduce to 23% if the target is more than 500 kg ha^{-1}. For straw, the two inputs can yield a gain of more than 500 kg ha^{-1} with a probability of 67% while 1000 kg ha^{-1} is expected with 55% probability.

From the state's perspective, more than 500 to 1000 kg ha^{-1} of grain can be produced with probability, 72% down to 35% using the two inputs while the probability values are much lower, 57% down to 14% following farmer's practice. On straw, there is very little or almost no chance (8% to 0%) of getting a yield target of 2000 to 3000 kg ha^{-1} under farmer conditions, while the use of inputs can raise the chances considerably (i.e. 56% to 34%, respectively).

Trial 4: In this case, the number of farms was rather small and varied from 7 to 11 under a combination of variety and fertilization. Effect of fertilization was significant ($P<0.05$) only for grain. The yield gap due to variety was 247 kg ha^{-1} (84%) on grain and 499 kg ha^{-1} (56%) on straw. Such a gap due to fertilizer application was 136 kg ha^{-1} (46%) for grain and 109 kg ha^{-1} (14%) for straw. The overall gaps due to fertilizer and varietal application were 541 kg ha^{-1} (186%) and 834 kg ha^{-1} (108%) on grain and straw, respectively (Table 4).

Trial 5: Only effect of fertilizer application was considered on the farmer variety. We, therefore, examined the distribution behavior and test of significance due to fertilizer application on yields. Gain due to fertilizer on grain as well as straw yields were normally distributed based on the sample of 26 farms. From the State's perspective, the Kolmogorov-Smirnov test as well as two-sample t-test indicated significant difference ($P<0.05$) in mean values under the two levels of fertility. A paired t-test indicated farmers' perspective with significant effect ($P<0.001$) of fertilizer application. Estimates of the gap due to fertilizer on grain and straw were 468 kg ha^{-1} (64%) and 822 kg ha^{-1} (61%), respectively (Table 4).

Trial 6: As in Trial 5, the only effect of the fertilizer application was considered on the farmer variety. Yields under farmers' condition (fertility management) were normally distributed. Kolmogorov- Smirnov indicated significant differences in grain yield due to fertilizer application but no significant effect on straw. Under assumed normality of yields, the differences due to fertilizer application were significant ($P<0.05$) on grain with a gain of 53% and straw yields with a gain of 58% (Table 4). From farmer's perspective, pair-wise t-test indicated significant differences ($P<0.001$) in grain and straw yields due to fertilization.

DISCUSSION

The results show that the best- bet package has a great potential in improving barley grain and straw yields. The performance of the package was consistent over the years and locations even with high variability of rainfall. This stability of performance reflected in the low risk involved when the package was applied, which is an important factor in increasing the adoption rate of the package by farmers. This has been confirmed by an adoption study that was carried out on farmers who cooperated with the project for one season. The study also aimed to find out if those farmers continue to apply the package in their barley cultivation. The result of the study (Tutwiler et al.,1997) indicated that the percentage of farmers who adopted the package by the end of the project (1994) was 33% as compared to 2% at the beginning of the project in 1989. This indicates that farmers found the best-bet package to have a better return with lower risk. The present computation of riskiness is approximated using mean and standard deviation of normally distributed yield but other approaches of risk analysis could also be explored. The profit of using the package was also confirmed by a study conducted by Driouchi and Boulif (1992) who found that the net return from applying the package is positive and greater than the return achieved with their traditional practices. This extra return came from the greater yield that was obtained due to the package. Further, variation in the input levels applied by the farmers could have been associated with the cost of the inputs and could form basis for a future study.

However, the number of farmers who adopted components of the package (minimum inputs) was greater than that of farmers who adopted the full package. One explanation for that is the unavailability of machinery, especially the chisel plow and the seed drill that is needed for the successful implementation of the package. Therefore, farmers look for acceptable alternatives.

The results call for the Government and the concerned private sector to invest in providing the requirements of the package, especially machinery. This will give an excellent opportunity to increase barley yield substantially and, as a result, improve the national barley production, which will help in reducing imports.

CONCLUSIONS

The use of the 'best-bet-package' showed considerable yield increases both from farmer's perspective and from the State perspective. Risk assessment indicated positive yield gain in using the package. The contributions of the component input factors showed substantial increases in the yields. Over the five trials, contribution of improved variety over the farmer variety varied in the range of 3-84%, application of fertilizer in the range of 36-54%, and together contributed in the range of 45-186%. Thus, the whole package or use of component inputs results in substantial gains to the farmer to feed barley grain and straw to livestock which will improve the economic status of the farmer. These increases in turn would increase meat production in the region and thus contribute to a better quality nutrition and improving the health of the people. The success of the technologies are not restricted to Jordan, but could be extended to other countries of the Mashreq region where similar climatic conditions prevail. The two approaches for assessing the performance of a new technology compared to that of the farmer's practice could be used in studies with objectives and data design similar to those in the present study.

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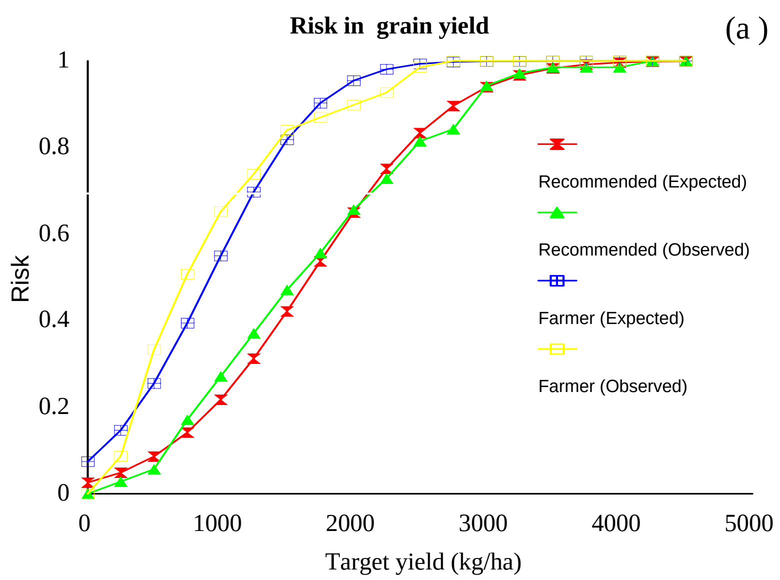
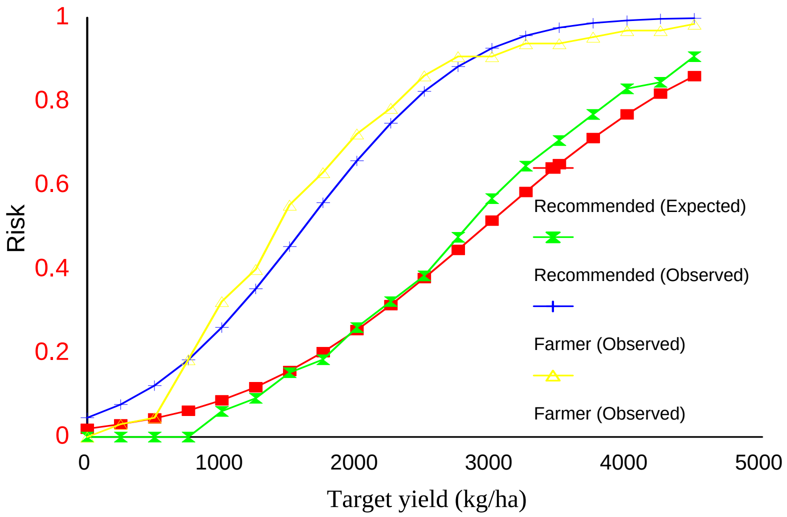
Figure 1: Observed and expected risk curves for achieving target grain yield (a), straw yield (b), and gain in grain and straw yields (c) under the best-bet- package (Trial 1).



Risk in straw yield

(b)



Risk in gain (grain, straw)

(c)

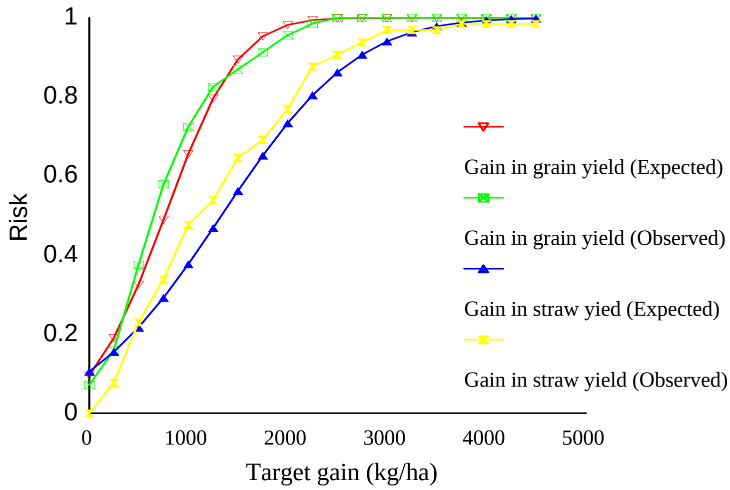


Table 1. Details of trials in terms of sample sizes and technological packages.

Trial	Year	Governorate	Site	Total farms
Trial 1	1989/90-93/94	N,C,S	9	70
Trial 2	1989/90-93/94	N,C,S	9	27
Trial 3	1990/91-91/92	N,C	11	26
Trial 4	1991/92	N,C	8	18
Trial 5	1990/91-93/94	N,C	8	26
Trial 6	1992/93-93/94	N,C,S	11	28

Trial 1: Best-bet package demonstration; Trials 2- 4: Minimum input technology demonstration with cultivar and fertilizer effects; Trials 5-6 Minimum input technology demonstration with fertilizer effect only. N: North, S: South, C: Central (Jordan);

Table 2. Mean and standard deviation of grain and straw yields (kg/ha) and gain due to the best-bet package (BBP) over the farmers' practice (FP) according to the geographical areas and rainfall zones, Trial 1.

(a)	Governorates		
	North	Central	South
Grain yield (under BBP)	1850 ± 962 (26)†	1370 ± 736 (21)	1737 ± 816 (23)
Grain yield (under FP)	1189 ± 688 (26)	690 ± 533 (20)	817 ± 590(23)
Gain in grain yield	662 ± 394 (26)	720 ± 605 (20)	919 ± 739 (23)
Straw yield (under BBP)	3055 ± 1441 (24)	3476 ± 1613 (21)	2248 ± 976 (20)
Straw yield (under FP)	2050 ± 1120 (24)	1555 ± 785 (21)	1138 ± 689(20)
Gain in straw yield	1005 ± 744 (24)	1921 ± 1444 (21)	1111 ± 679 (20)
(b)	***Rainfall Zones***		
	<=250mm	250-300 mm	>350 mm
Grain yield (under BBP)	819 ± 459 (9)	1463 ± 720(10)	1809 ± 853 (34)
Grain yield (under FP)	467 ± 294 (9)	558 ± 382 (9)	1054 ± 690 (34)
Gain in grain yield	352 ± 220 (9)	1004 ± 444 (9)	755 ± 658 (34)
Straw yield (under BBP)	1852 ± 886 (9)	2526 ± 656 (9)	2996 ± 1314 (30)
Straw yield (under FP)	1167 ± 340 (9)	1277 ± 515 (9)	1716 ± 1138 (30)
Gain in straw yield	685 ± 732 (9)	1250 ± 561 (9)	1280 ± 776 (30)

† : The parantheses contain the number of farms in the governorate and the rainfall zone.

Table 3. Mean and standard error (SE) of grain and straw yields (kg/ha) under farmer variety and improved variety (recommended input), unfertilized (-F: farmer practice) and fertilized (+F: recommended input) under minimum-input demonstration Trials 2-6.

	Grain			***Straw***		
	-F	**+F**	**mean**	**-F**	**+F**	**mean**
Trial 2:						
Farmer variety	787	1209	998	1972	2792	2292
Improved variety	995	1476	1235	2572	3463	3018
SE	± 81		± 58	± 139	± 99	
mean	891		1342	2182	3128	
SE	± 58				± 99	
Trial 3:						
Farmer variety	520	705	613	920	1390	1155
Improved variety	538	754	646	1445	2093	1769
SE	± 46	± 34		± 141	± 102	
mean	529	729		1182	1742	
SE		± 34			± 102	
Trial 4:						
Farmer variety	293	428	381	769	878	840
Improved variety	540	834	732	1268	1603	1487
SE	± 81	± 68	± 53	± 209	± 173	± 136
mean	416		631	1019		1241
SE	± 58		± 50	± 150		± 129
	Grain			**Straw**		
Trial 5:						
	Mean		**± SE**	**Mean**		**± SE**
No fertilization	734		± 122	1352		± 184
Fertilization	1202		± 155	2174		± 255
Trial 6:						
No fertilization	839		± 102	1503		± 173
Fertilization	1281		± 136	2376		± 299

Table 4. Mean and standard error (SE) of yield gaps (kg/ha) due to variety, fertilizer and both grain and straw (kg/ha) under minimum-input demonstration Trials 2-6.

Source	Grain		Straw	
Trial 2:				
Variety	208		780	
Fertizer	422		1000	
Overall	689		1671	
SE	± 114		± 197	
Trial 3:				
Variety	17		525	
Fertilizer	185		470	
Overall	233		1173	
SE	± 65		± 199	
Trial 4:				
Source	**Grain**		**Straw**	
	Mean	± SE	Mean	± SE
Variety	247	± 115	499	± 296
Fertizer	136	± 106	109	± 271
Overall	541	± 106	834	± 271
Trial 5:				
Fertilizer	468	± 68	822	± 125
Trial 6:				
Fertilizer	442	± 55	873	± 206

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تقييم أداء الحزم المحسنة لانتاج الشعير تحت ظروف المزارع في الاردن

نصري ابراهيم حداد*، موراري سنغ** وقاسم ممدوح**

ملخـص

هدف مشروع المشرق الذي نفذ في الأردن إلى زيادة إنتاج الشعير من أجل توفير الأعلاف إلى الأعداد المتزايدة من الأغنام، مما يؤدي إلى تقليل الضغط على المراعي الطبيعية المتدهورة. تم تطوير تقنيات لزراعة الشعير في محطات البحوث ومن ثم تم اختبارها تحت ظروف حقول المزارعين في مساحات كبيرة نسبياً. نفذت مشاهدات في حقول المزارعين استعملت فيها "حزمة التقنيات الموصى بها" ومشاهدات استعمل فيها عامل أو أكثر من الحزمة الموصى بها..تم تحليل النتائج لتقييم أثر حزمة التقنيات من منظور المزارع ومن منظور المؤسسة الرسمية التي طورتها. وعند أخذ معدل سبعين مشاهدة نفذت في تسع مناطق وخلال خمسة مواسم زراعية، أدى استعمال حزمة التقنيات إلى زيادة الإنتاج من الحب بنسبة 81% عن ما تم الحصول عليه باتباع أسلوب المزارع في الزراعة. أدى استعمال الحد الأدنى من المدخلات (السماد والصنف المحسن) إلى زيادة نسبتها 38% في إنتاج الحب نتيجة استعمال الصنف المحسن و 51% نتيجة استعمال السماد. وعند إضافة السماد إلى الصنف المحسن، أدى ذلك إلى زيادة نسبتها 106% عن الإنتاج عند استعمال صنف المزارع بدون تسميد. أظهرت دراسة المخاطرة أن المردود من استعمال الحزمة كان إيجابياً. وتبين أن المزارعين قد تقبلوا التقنيات الموصى بها من قبل المشروع في مناطق أخرى من الأردن ودول أخرى مشاركة في المشروع. وهذا يشير إلى إمكانية الحصول على مردود مجز في زيادة إنتاج الشعير عن طريق تطبيق التقنيات الموصى بها في مناطق جديدة ذات ظروف مناخية مشابهة.

الكلمات الدالة: تجارب في حقول المزارعين ، تقنيات إنتاج الشعير، الأردن.

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