A Feasibility Analysis on Crops Yield to Climate Change by the Implement of CROPG Model

Bekhzod Burkhanov [1,2], Mardiev Shakhbozjon Husan Ugli [2],Axmedjanova Gulnora Teshaboevna [2], Masharifov Umidbek [1,2],Mamataliev Adham Boymirzaevich [2]

[1]Hohai University, Nanjing 210000, Jiangsu, China;

[2]Tashkent institute of irrigation and agricultural mechanization engineers- national research university, Tashkent 100000, Uzbekistan;

e-mail: mamoonmamoon394@gmail.com

Abstract

Process-based plant reproduction models help reproduce the effects of environmental change on editorial aggregation. So far, the adjustment of the land space boundary assessment can pose a challenge for the generation model as it requires remote and detailed information from multiple posts. Information integration areas have been proposed for model alignment but not local environmental change studies. This labor data exploration aims to measure CROPG, factory model, and programming constraints to align the model and adapt future ecological information to assess the impact of environmental change. The CROPG crop model has produced basic cultivated area types, crop yields, and current environmental data at the regional and national level collected during Alabama through 1981-2010. It can be ascertained that the copy adjustment model is based on about 29 prizes up to the execution mark - 43 or the setting is 0.41~0.81. The pooled yield is projected to fall by 19% by 2075, 33%, 29%, and 55% by 2045, with fixed fractions of 4.5 and 8.5, respectively. Therefore, this tip is the most heat-adapted end, which is expected to strengthen the water system to maintain soil moisture to match a reasonable harvest speed. Suitable reproduction and yield of CROPG plants suggest that the harmful consequences of increasing Temperature can modulate body weight by expanding rainfall, improving water systems, and development.

Keywords: *Climate Change, Crops, CROPG model, ecological*

1. Introduction

The variability of the environment worldwide depends on falling impacts and creating healthy plants. This evaluation of potential IMM contracts requires multiple crop-based crop models to reproduce some collaboration between plants, conditions (climate and land), and expected management practices and conditions of future implementation in the environment. The plant model that is commonly used is plant development (plants). This is an oat nut model considering the Soygro, Beanro, and Pnutgro models. Numerous adjustments and inspections of crop plantings have resulted in models reproducing crop progress and the perceived consequences of seed across various climatic conditions and locations.

Completing this factory replay model relies on the accessibility of remote testing and information for fine-tuning. However, adopting this model presents many difficulties in studying local environmental changes. First, obtaining comprehensive, long-term (30 years) information and local crop development isn't easy based on point-by-point, harvest, and planting board records for routine model adjustments. Second, the description of soil attributes in soil review reports is less varied, especially the intricacies of materials science and material boundaries required for the components of soil assessment (water, air, supplement) and soil structure.

One way to overcome this difficulty is to use item-by-item information (e.g., applicant, development, nitrogen land status, etc., and yield and yield and occasional information sections) obtained from sentinel areas such as agricultural analysis stations and information sections. Agriculture, Therefore, several tests have been carried out to assess the impact of environmental changes on a local scale. During 1980-1993, item-by-item exploratory information from the Bulgarian survey was used to adjust and examine the maize and wheat care model. In investigating environmental changes and the effects of environmental changes during maize development in the United States Midwest, two picking agents in Illinois have obtained information from the 1975-1990 experiments identified to harmonize and test the Ceres-maize model 1961 1990 Year of exploratory information was used in conjunction with station inspections. Ceres calibration, CROPG, and decommissioning models focused on environmental change impacts at a Quebec, Canada plant.
The following strategy is to evaluate the boundaries of spatial factors to fit the crop model in framing, progressive and emotional techniques.

Given that the soil remains unchanged over the years, the inversion indicates that the actual results understand the elimination of special effects and evaluate the choice of soil boundaries. This is done either physically or using computations, methodically controlling area boundaries until Chronicle generates replicated results to reproduce the model, a scalable survey showing a low Root Mean Square Error (RMSE), and a high D measurement. Production is an essential part of Alabama's economy, with five of the state's key factories. Plants serve as a source of food and fodder in Alabama. The motivations behind this research are 1) soil boundaries of the sentiment indicators of plant models depending on the Chronicle of future people, 2) assessment of yield-level techniques to reconstruct model-level, 3) use of adapted models to assess the impact of changes in the Alaba environment. on plants.

2. Methodologies

2.1. Concentrate on Area

The audit objective reviews four regions in the US province of Alabama that are among the top reapers in the state, with recorded yield experiences accessible to the average individual. Locales are likewise chosen to address inheritance or spatial examples across the state to effectively combine the different environment plans between the southern, central, and northern areas of the state. The test regions chosen were Limestone (34˚50'N, 86 56'W; 207 m), DeKalb (34˚31'N, 85˚41'W; 297 m), Dallas County (32˚13'N, 87 8'W; 44 m) and Baldwin (30˚36'N, 87˚46'W; 44 m) (Fig. 1)

Figure1. Study Area

2.3 Sources of Plant Model Information

2.3.1. climate information

Daily climate information (minimum and maximum temperature, precipitation, solar radiation) for each page is obtained from the United States Agricultural Survey Service (USDA-ARS) website (http://ars.usda.gov/Exploration/docs.htm)? docid=19422) and the Public Aerospace Organization Total Energy Assets Forecast (NASA-POWER) website (http://power.larc.nasa.gov/cgi-canister/cgiwrap/sun based/agro.CGI?email=agroclim@larcnasa .gov).

2.3.2 Crop Yield Information

Crop Records Yield information for 1981–2010 was obtained from the United States Horticulture Public Agricultural Insights Administration (USDA-NASS), Alabama Field Office, Regional Assessment Division. This information was collected for the Limestone, De Kalb, Dallas, and Baldwin areas. Territory selection depends on high harvesters, a horticultural inspection community, and the availability of information and regions such as northern, focal, and southern parts of the state. During this period (1981-2010), the outstanding yields showed an optimistic yield pattern (Figure 2).

These logged yields were deleted/altered according to the elimination of the innovation effect using the generalized baseline direct repeat model [time = independent yield metric]. The demands on this system stem from innovations in how positive yield patterns affect nearly all crops in the United States.

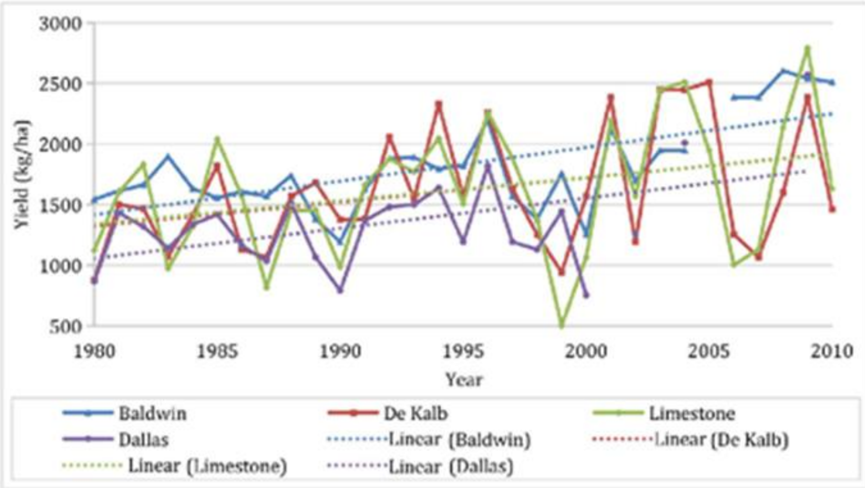

Figure 2: The outstanding yields showed a optimistic yield pattern

2.3.3. Clipboard Information

The Incorporation Window is assessed based on the founding date of the United States Agribusiness Public Rural Survey Service (USDA-NASS). This model is designed to simulate formation when the lowest end of the groundwater reaches or exceeds 70, and the soil is sufficiently heated. The rate and depth of nitrogen application, such as path and crop division, and the depth of utilization depend on the Alabama Station of Horticultural Analysis (AAES) recommendations. Therefore, the review destination did not have the water system and pesticide application intended by the review and was not taken into account.

2.3.4. Breed and Genetic Coefficient

Due to climate, soil conditions, and executive exercise, this model uses a unique arrangement of genetic coefficients to simulate and predict the day-to-day growth and development of crops that represent harvested cultivars. The review uses model-approved non-exclusive yield coefficients for various yield development (MG) pools. MG 5 was used in the Limestone and De Kalb areas, while MG 6 and MG 7 were used in the provinces of Dallas and Baldwin.

2.3.5. land information

Most soil sequences used for horticultural purposes are recognized from the USDA Soil Survey and Distribution Works and are used as replacement soils for review sites.

2.3.7. Carbon dioxide production affects DSSAT. replication

Another part of environmental change that affects crop yields is carbon dioxide. An increase in carbon dioxide concentration affects outcomes in two ways: increasing photosynthesis and better water availability to reproduce the preparative effect of carbon dioxide on plant physiology. Carbon dioxide fixation rates are expressed directly in natural variation in DSSAT.

2.4 Definition of Land

This study uses a post-throw technique to adjust the boundaries of the selected land using a step-by-step strategy. Soil boundaries that characterize water accessibility, water retention, fertilization, and root development are chosen, and their potential mass is defined in the

Alabama area based on field estimates. The reason for this is to have a great starting point to help simplify ground boundary adjustments. The optimal frontier increment was selected by reproducing 30 years of results recorded in the CROPG-Harvest model and using the recorded dissipation map that was modified based on the model presented in terms of eliminating the effect of innovation and evaluating the imitation aspect. Then select the boundary array that gives the highest d-measure and the smallest RMSE. To further investigate the adjustment accuracy and insight of the CROPG-Yield model, this review uses scatter plots to evaluate model reconstruction and estimate information. Paying attention to the scatter plot of the results versus the reconstructed results allows the modeler to analyze the manual movement of the different soil boundaries means for reformulation of the results.

It is scheduled to begin on January 3 each year, before the reenactment begins. For each dirt in the objective of the review, the maximum soil breaking point (SDUL), extracted soil limit (SLL), farthest submerged breaking point (SAT), soil richness element (SLPF), and manure root development element (SRGF) were determined. For each dirt layer, the delta for each layer in the profile (the contrast between the maximum limit value for depletion (DUL) and lower limit (LL)) is first set to the initial stage of the comparison: 0.100 cm3/cm3. The delta shift by adding or subtracting 0.005 cm3/cm3 in LL or DUL while examining the lower end of the scatter plot to see how well the reformulation results compare with the standard long-term confined water observations. SAT quality is considered when delta changes no longer affect model execution. The SAT mass is gradually shifted by ±1 cm3/cm3 while examining how the reformulated results replicate the results recorded in plots spread over water-saving years. This research ensures that SAT quality is always more concerned than DUL suggests. Importantly, each progressive layer contains the base layer's SAT scores before creating a good action. The SLPF of each impurity (size 0 - 1) was first set to 1.00 to give an initial phase of comparison, then shifted by ±0.01 while checking the higher completion of the 1:1 scatter plot to see the effect of the replicated reformulation results in Upward (high) results in the benchmark for an extended period of time. After the enhancement was completed, the SRGF was set to 1 in the layer with the highest point of the mid-spaced surface 30 cm. The lower initial phase SRGF of the overlayer below was evaluated using the defined relationship and gave a significant 1× (-0.02 layer center), as desired depth from the highest point of the soil surface to the layer focus.

2.5 Environmental change impact assessment

The assessment of the response of harvests to future environmental conditions, this review uses the DSSAT v4.6 interim survey procedure, through which interim testing is performed, model reproduction is run, and finally, a biophysical examination of the model results is completed. In the evaluation process, executive factors, genetic coefficients, and high-level soil profile results reproduced in the current environment were used as informative information. Apart from the current climate information, future environmental conditions obtained from MarkSim are remembered for checking. Checks were made between the average model results and future ecological conditions with and without carbon treatment. Investigate the effect of carbon preparations on plants, and carbon dioxide foci were altered in the environmental change section of DSSAT v4.6, in each of the forthcoming climatological drugs, as shown in Table 1.

3. Results

3.1. Adjusted Yields

The de-trending/adjustments of crop yields resulted in trend line gradients

Table 1. Addition of carbon dioxide in the retrofit section of the DSSAT environment.

Treatment Name	Carbon dioxide additions
CM5A-MR RCP 4.52075 IPSL-	132 ppm
5 RCP 4.52075 MIROC	133ppm
CM5A-MR RCP 8.52075 IPSL-	321 ppm
5 RCP 8.52075 MIROC	321 ppm

All provinces are close to zero (Figure 3). The excess residue on the graph shows the difference in annual yield between varieties due to climate. This change brought crop yields down to complete a more or less stable period of innovation.

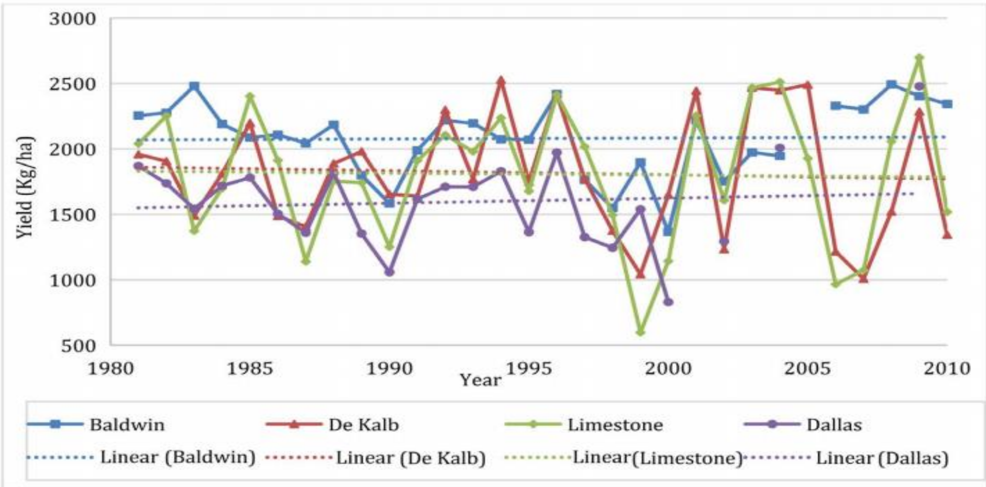

Figure 3. Adjusted county crops yields

3.2 Ground boundaries for model alignment and assessment

Dirt Fruitfulness Element (SLPF) values changed from 0.572 to 0.758 (Table 2), which is within the mass range supported in writing (Irmak et al., 2001; Mavromattes et al., 2001). The delta (DUL-LL) varied from 0.085 cm3/cm3 to 0.220 cm3/cm3 for the fouling profile layer in different regions. The last soaking point/soil volume (SAT) value was between 0.449 cm3/cm3 and 0.690 cm3/cm3 (Table 2). This delta elongation (DUL-LL) and SAT decreased SLPF, which resulted in a lower and more prominent RMSE level than the 0.-7day measurement.

Soil root development elements (SRGF) move through different layers in each region. Slightly higher RMSE levels indicate gaps in crop annual yield reproduction, possibly related to biological anxiety (infection, insects, etc.) that the model does not reproduce. It is considered in the model. The harmonized final SDUL and SLL values are in the surface and water treatment information results. The non-exclusive DSSAT crop heritability coefficient in this episode and differing skepticism may add to the higher susceptibility.

The Model R box quality is neglected in evaluating the model's performance because the review uses time-series information on automatic connection quality (30 years recalled return). In this issue, relationship-based insights (d-measurement and RMSE-effectiveness measure) were used to evaluate the model's performance. Yield reproduction was very similar for the DeKalb and Dallas regions, whereas, for Limestone and Baldwin, the model slightly overestimated the high-yield years and underestimated the low-yield years. More prominent than the 0.7-day measurement, indicating that the reconstruction of the results of the CROPG-Crop model is very consistent with the recorded results.

3.4 Environmental change impact assessment

The replicate results reflect the response of the three development groups (MG5, MG6, and MG7) to different predicted environmental and soil conditions in other regions. The De Kalb and Limestone areas both simulated the production of the MG5, while Dallas and Baldwin replicated the MG6 and MG7 development strings.

Table 2. Under current and projected environmental conditions, average annual rainfall, most extreme and minimum temperatures for each study site.

Climatic Variables	**County**			
	Limestone	De Kalb	Dallas	Baldwin
Rainfall (mm)				
Current Rainfall	1441	1401	1371	1620
RCP 4.5-M 2045	1464	1452	1567	1603
RCP 4.5-I 2045	1448	1438	1488	1600
RCP 8.5-M 2045	1491	1448	1384	1581
RCP 8.5-I 2045	1468	1430	1256	1577
RCP 4.5-M 2075	1453	1431	1340	1567
RCP 4.5-I 2075	1453	1426	1261	1580
RCP 8.5-M 2075	1524	1427	1324	1564
RCP 8.5-I 2075	1487	1419	1164	1491
Maximum Temperature (˚C)				
Current Tmax	22	21	24	25
RCP 4.5-M 2045	24	24	26	27
RCP 4.5-I 2045	25	23	26	28
RCP 8.5-M 2045	25	24	26	27
RCP 8.5-I 2045	25	23	27	28
RCP 4.5-M 2075	25	24	27	28
RCP 4.5-I 2075	25	25	27	28
RCP 8.5-M 2075	26	26	28	29

RCP 8.5-I 2075	27	26	29	29
Minimum Temperature (˚C)				
Current Tmin	9	8	11	14
RCP 4.5-M 2045	11	10	13	16
RCP 4.5-I 2045	11	10	14	16
RCP 8.5-M 2045	11	10	13	16
RCP 8.5-I 2045	11	10	14	16
RCP 4.5-M 2075	11	10	14	16
RCP 4.5-I 2075	12	10	14	16
RCP 8.5-M 2075	12	12	15	17
RCP 8.5-I 2075	14	13	16	18

Respective provinces. Rains are produced without CO2 in 2045 and 2075, first with a survey in 2075, followed by an examination of CO2 processing in the rains of 2075, when CO2 fixation is estimated to exceed 100 ppm. Figures 4 and 5 show the perceived change in the projected future average crop yield compared to the current baseline expected yield. The results of the 2045 replication showed that crop yields decreased in all regions under both environmental scenarios (Figure 4). Production is expected to fall for RCP 4.5 and RCP 8.5 2045 by 8% to 74% and 8% to 51%, respectively.Replication in 2075 shows a general decline in yields in the region under both environmental scenarios (Figure 5). Production is expected to fall 5% to 43% for RCP 4.5 and 16% to 64% for RCP 8.5. Whenever CO2 show is brought into the replication yield of the IPSL-CM5A-MR scenario in 2075, the reduction is lower than reformulation without CO2 (Figure 6). This reduction is approximately 12% to 19% lower in the medium emission scenario (RCP 4.5) and 8% to 18% lower in the high emission scenario (RCP 8.5) than the replica prepared without CO2. In the moderate emission scenario, the CO2 treatment contributes to a 10 percent increase in production in Limestone County. In general, carbon dioxide

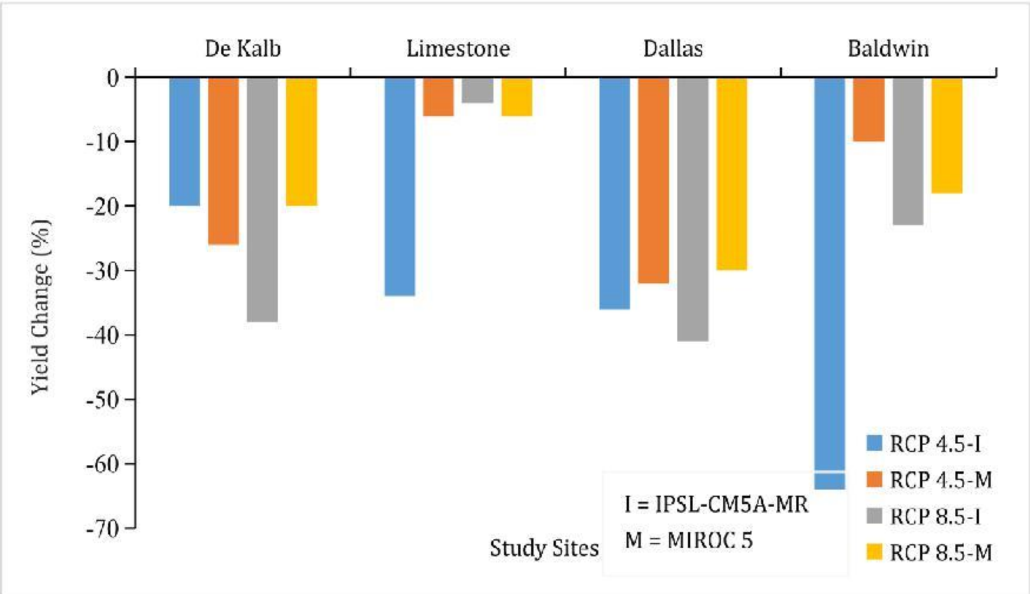

Figure 4. The crop yield changes (2045).

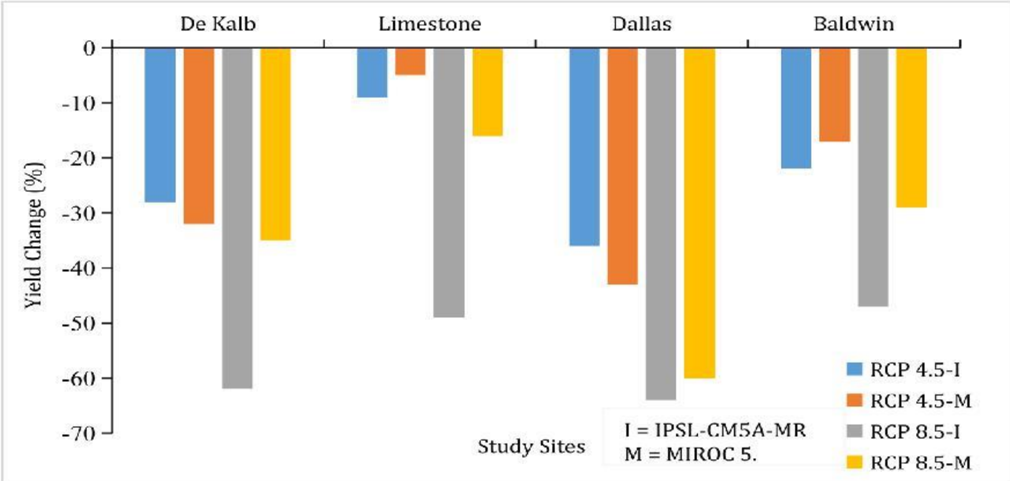

Figure 5. The crop yield changes (2075).

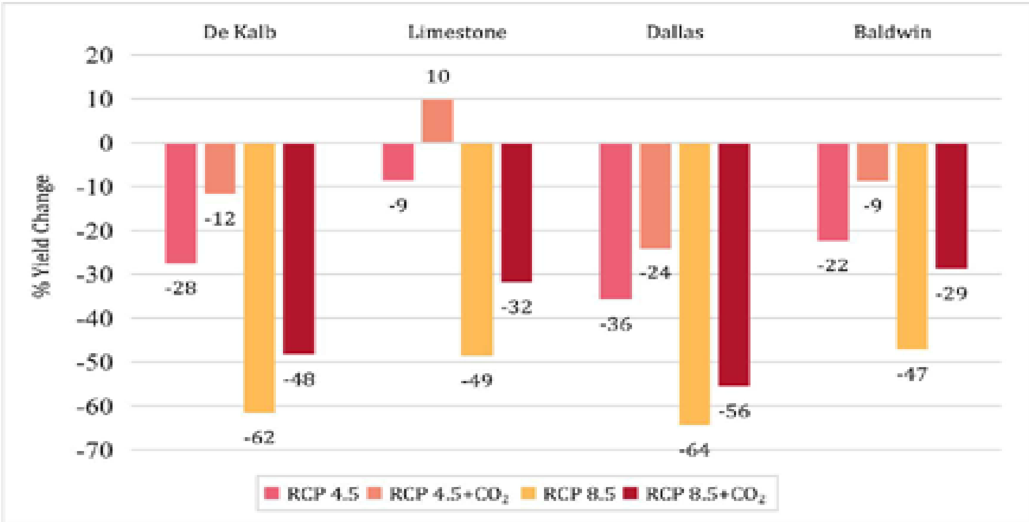

Figure 6. IPSL-CM5A-MR scenarios for projected changes in crop yields in 2075. Expected with and without CO2 fertilization.

Whenever CO2 production is included in the reproduction of yields in the 2075 MIROC 5 scenario, the reduction is also lower than that of reproduction without CO2 (Figure 7). This reduction is approximately 15% - 23% lower in the medium emission scenario (RCP 4.5) and 22% - 32% lower in the high emission scenario (RCP 8.5) compared to the "no CO2 treatment" iteration. At RCP 4.5 and RCP 8.5, CO2 production contributed to a 14% and 12% increase in output in Limestone County, respectively. In general, over the 2075 (2060-2090) timeframe, the impact of CO2 production causes a projected reduction in average production of 7% and 9%, respectively, at RCP 4.5 (medium outflow) and RCP 8.5 (high emissions). In Limestone County, the impact of carbon dioxide treatment is large enough to offset the adverse consequences of environmental change, with projected yield increases of 14% and 12% in the medium and high outflow scenarios, respectively. These results are consistent with different examinations showing that increased carbon dioxide in the environment may have a paying effect on wrinkling yields.

4. Discussion

The inspection results are characterized by the new response of the results to temperature increases and the ability of the model to capture this response. In plants, the vegetative and regenerative stages coexist during the yield life cycle period. Once the Temperature exceeds the ideal value, such as 22°C - 28°C, their vegetative development period is extended, and the results are extended continue to be presented at this Temperature. The view from field trials shows that this temperature-induced extension of the life cycle promotes increased resource expansion for leaf area and leaf photosynthesis, which increases photosynthesis and adaptive allocation, thereby increasing yields. However, temperature expansion, which has been shown to delay and enhance plant development and vegetative progress, further promotes regenerative development, reducing the number of seeds produced. The findings indicated that if the Temperature could be extended during flowering, regeneration could be prevented from developing, as there was no relationship between mean Temperature and the post-flowering period. The responses of different formation stage to temperature and environmental impacts as temperatures increase may explain the conflicting reactions in the medium to high emission scenarios of the reformulated harvest development bundle in the Limestone and Baldwin regions.

Furthermore, cultivar-specific day length prerequisites influence how different harvest development aggregates respond to increasing temperatures. It shows that for early developmental totals, increasing temperature results in more restricted periods of vegetative development, lighter leaf zones, earlier blooms, case settings, and possibly yield reduction. In addition, the demonstration showed that yield reduction due to temperature increase was more moderate in late growing harvest sets (higher developmental sets and higher day length sensitive location), suggesting yields in later developing cultivars. This explains why MG7 mimicking soil with impervious water retention limits in Baldwin County exhibits strength under changing environmental conditions.

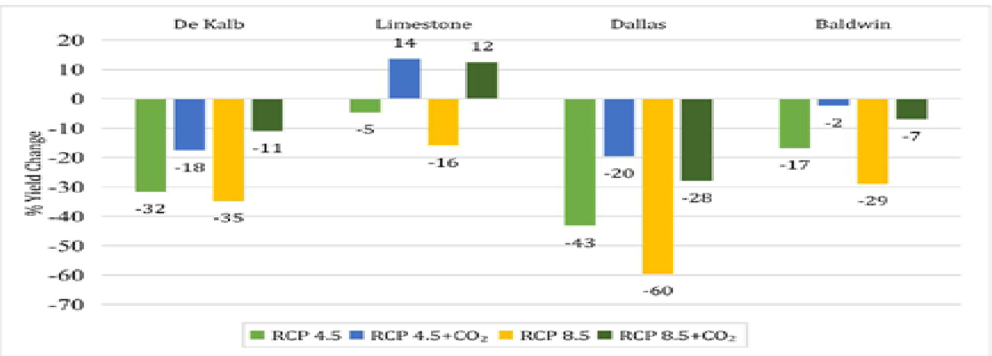

Figure 7. MIROC 5 developments for projected changes in crop yields in 2075. Expected with and The CROPG-Crop model demonstrates how increasing Temperature in future environmental without CO2 fertilization.

situations affects theory time (and thus seed development) and developmental opportunities (Figures 8 and 9). Both shortening and elongation of the developmental stage depend on whether the Temperature exceeds the ideal harvest temperature (22°C - 28°C). The exploration period is extended from 1 to 6 days depending on the site area, GCM, RCP conditions, and recreation year. The shortened repair phase leads to a shorter life cycle, which means that the crop will not have an ideal opportunity to take advantage of the available assets, resulting in lower yields. Similar inspections observed that hasty development and shortened life cycles increased profits. The Extending the improvement phase, particularly opportunity exploration, increases or decreases yield. Since the vegetative and regenerative phases coexist, the available development opportunities are different.

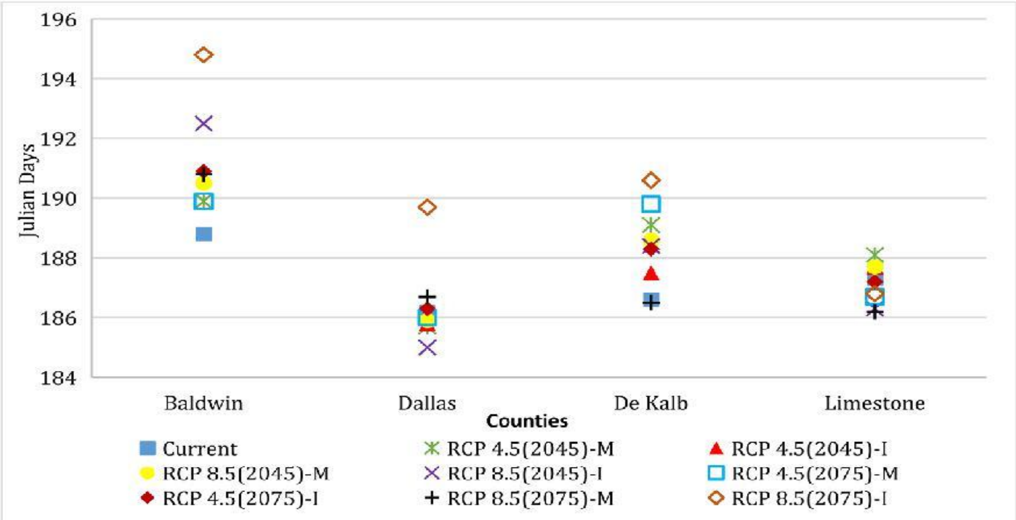

Figure 8. Figure 8. Plant flowering dates in relation to recreational conditions MIROC 5 (M) and IPSL-CM5A-MR (I)

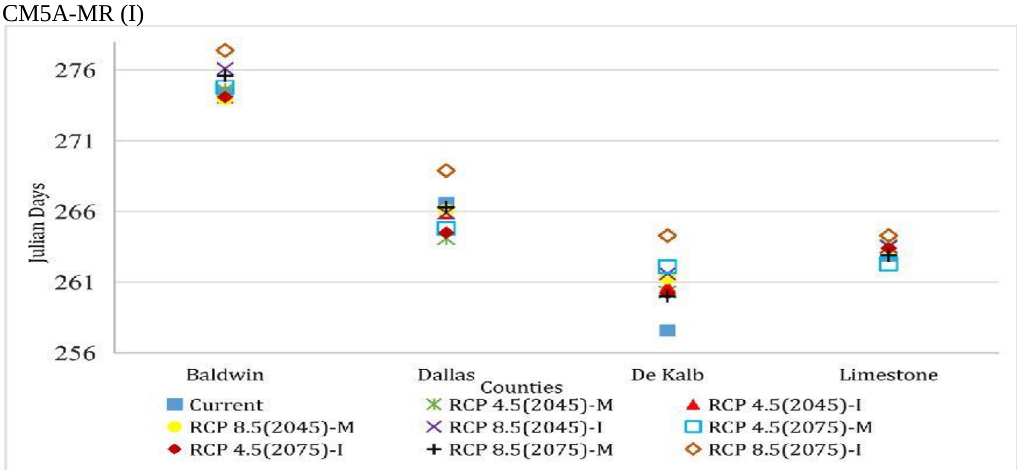

Figure 9. Plant development dates in leisure conditions MIROC 5 (M) and IPSL-CM5A-MR (I).

The CROPG-Crop model revealed distinct and intrinsic responses to environmental changes across various yield development assemblies. MG5 simulates Decatur sedimentary topsoil in Limestone County, a soil with a high water retention limit that is less susceptible to environmental changes. At the same time, MG7 replicates in Baldwin County with a Duson sandy topsoil, a soil with a low water retention limit, Also showing versatility with changing environments because this is a late-growing breed.

Conclusions

This study uses a stepwise post-casting strategy to measure spatially factored soil boundaries to fit the CROPG-Crop model. The model hastily investigated its performance with various mixtures of soil boundaries and used a 1:1 dissipation map to define and select boundary arrays to give the highest d-measures and the lowest root means square error (RMSE). The survey found that assessing land boundaries using the collected territorial information regional level information for this case) results in consistent model reproduction that reflects local results well over long distances under current environmental conditions, thereby guaranteeing local conditions. swayed. This practical strategy utilizes a cumulative index of territorial information to align harvest models with verifiable yields. The adjusted yield model indicated that environmental changes would adversely affect plants under the moderate (RCP 4.5) and high (RCP 8.5) radiological limits used in the review. Under RCP 4.5 and RCP 8.5, crop yields are projected to decline by 29% and 23% in 2045 and 19% and 43%, respectively, in 2075. Compared to the case of IPSL-CM5A-MR, the reduction of projected emissions under the MIROC 5 case are lower, and the predicted temperature expansion and precipitation reduction under the IPSL-CM5A-MR case is outrageous. Given the on-going global efforts to moderate environmental change, the rationale for the review is that the impact of climate change on crop yields in Alabama must be within the projected range under RCP 4.5. Voice replays show that the decline in yields was mainly due to shorter plant life cycles. However, certain variables examined the effect of a shortened life cycle on crop yields. Factors such as limited soil water holding capacity, plant growth groups, time above ideal Temperature, and water availability during the growing season can affect how yields respond to environmental changes. A general negative yield forecast is a clear requirement for moving forward with changing procedures and arrangements to support current yields. It may include the transition of new development sets and the development of further developed heat-resistant varieties

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