中国农业产业发展报告 2020

编著委员会

中国农业产业发展报告 2020
（简版）

2020 年是全面建成小康社会和“十三五”规划收官之年，也是脱贫攻坚决战决胜之年。在新冠肺炎疫情的影响下，国内外经济社会形势发生明显变化。习近平总书记强调，要统筹推进疫情防控和经济社会发展工作，特别是要抓好涉及决胜全面建成小康社会、决战脱贫攻坚的重点任务。在此背景下，守好“三农”战略后院是奋力夺取疫情防控和实现经济社会发展目标“双胜利”，确保如期全面建成小康社会的坚实基础。

《中国农业产业发展报告 2019》提出，农业—食物系统是乡村振兴产业兴旺的“压舱石”，是保障就业的“蓄水池”，是促进国民经济发展的“战略后院”；以竞争力换农民收入是中国农业政策的重要特征之一；非洲猪瘟将导致猪肉消费需求和饲料需求下降。

2020 年，《中国农业产业发展报告 2020》继续突出战略导向、定量分析的特点，基于统计数据和中国农业产业模型（CASM）等前沿研究方法，从农业—食物系统的视角回顾与展望了国内外宏观经济和农业产业走势，梳理了 2019 年与农业产业发展密切相关的重大事件，从全要素生产率、国际贸易和生产成本三个角度剖析了中国农业产业竞争力，分析了新冠肺炎疫情对中国农业和农民收入的影响，评估了生猪产能恢复趋势及其主要影响因素，模拟了草地贪夜蛾对 2020 年中国玉米产业带来的影响，总结了 2019 年谷物、油料、畜产品、水产品 18 种重要农产品的产业发展特征，展望了相关产业 2020—2021 年的发展趋势。

一、2019 年农业产业发展回顾

回顾 2019 年，受贸易摩擦、地缘政治和衰退风险等重大不确定因素的共同

影响，世界经济增速降至2008年国际金融危机以来的最低水平，世界农产品产量增速放缓。中国国民经济运行总体平稳，发展质量稳步提升，主要预期目标较好实现；农业发展稳中有进、稳中向好，粮食产量连续5年站稳1.3万亿斤台阶，棉油糖生产保持稳定，果、菜、茶供应充足，生猪生产止降回升。

谷物种植结构调整继续推进。2019年，稻谷播种面积和产量持续下降；小麦、玉米种植面积下降，单产及总产增长。稻谷、小麦和玉米产量分别达到2.10亿吨、1.34亿吨和2.57亿吨。三大谷物总消费量达到6.12亿吨，较2018年增长0.41%。其中，稻谷消费平稳略增，小麦消费小幅增长，玉米需求整体放缓。贸易方面，稻米出口9年来首次超过进口，小麦、玉米进口呈增长态势。

大豆振兴计划实现良好开局。大豆生产继续回升，产量达到1 810万吨，同比增长13.5%；油菜播种面积和产量继续下降，花生产量持续增加。受非洲猪瘟疫情影响，豆粕饲用消费同比下降11.47%。大豆、油菜籽进口增加，花生净出口放缓。其中，大豆进口量达到8 851.1万吨，同比增加0.5%。

其他作物产量基本保持稳定，棉花产量下降。马铃薯产量维持在1亿吨以上，出口总量超过50万吨；受自然灾害等不利因素影响，棉花单产同比下降3.1%，总产量下降3.5%，净进口量达到179.8万吨，同比增加16.2%，美棉进口比例显著下降，巴西成为中国最大的棉花进口来源国。糖料、蔬菜、水果产量稳定增长；鲜或冷藏蔬菜出口量同比增长3.5%，按人民币计价出口额同比增长24.9%；鲜、干水果及坚果净进口量由2018年的224万吨增至2019年的348万吨，按人民币计价贸易逆差同比增长63.4%。

猪肉产量大幅下滑，鸡肉产量增长明显。由于非洲猪瘟疫情延续，2019年生猪存栏同比下降27.50%，猪肉产量4 255万吨，同比下降21.26%，但从下半年开始生猪存栏量开始环比上升；牛肉产量同比增长3.56%，牛源供求依然趋紧，犊牛价格不断上升；肉羊养殖积极性高，生产规模持续扩大；肉鸡生产大幅增长，白羽和黄羽肉鸡鸡肉总产量同比增长11.40%，产能居历史高位；鸡蛋产能提升明显，产量同比增长5.78%，蛋价及淘汰鸡价格高位盘整；奶业生产结构逐步优化，奶类产量保持增长；水产品产量基本稳定，7大重点流域禁渔期实现全覆盖，国内捕捞量下降明显，全国水产品养捕比达到78∶22。

二、农业产业竞争力

根据国情分品种制订农业产业竞争力目标，从更广义的视角看待中国农业产业竞争力。按照传统观点，一个产品在国际竞争中具备比较优势可以被认为具备竞争力。按照这个观点，2018 年中国谷物、油料作物和畜产品（不含禽类产品）的显示性比较优势指数均小于 0.8，即不具备国际贸易比较优势；园艺作物和禽类产品具备出口比较优势。但是部分农产品具有较强的基础性、公益性、社会性，不能仅以显示性比较优势等经济学指标来评判竞争力。

守住“口粮绝对安全，谷物基本自给”的战略底线是中国谷物产业最根本的竞争力目标。谷物是关乎国计民生的重要农产品，也是国际贸易比较优势较弱的

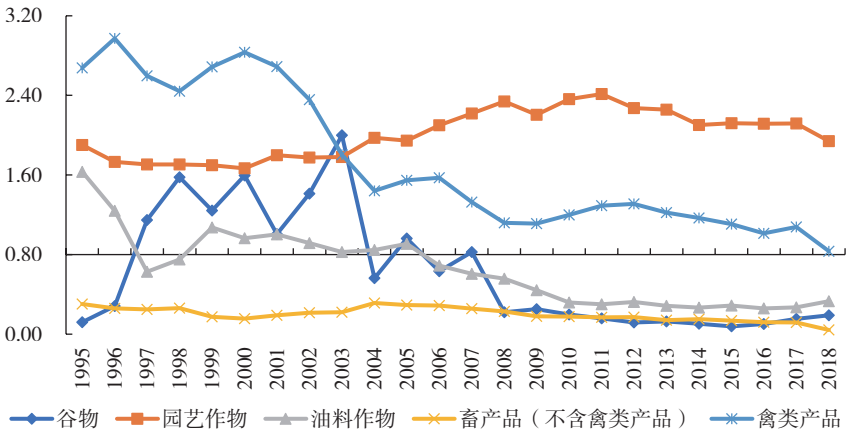

图 1　1995—2018 年中国主要农产品显示性比较优势指数

注：一般认为，显示性比较优势指数小于 0.8 时不具有出口比较优势。

资料来源：1995—2017 年谷物进出口额数据来自 FAOSTAT 数据库，界定为 Cereals；2018 年谷物进出口额数据来自 UN Comtrade 数据库，界定为 HS10；1995—2017 年园艺作物进出口额数据来自 FAOSTAT 数据库，界定为 Fruit and Vegetables；2018 年园艺作物进出口额数据来自 UN Comtrade 数据库，界定为 HS08 和 HS0702 ～ HS0712；1995—2017 年油料作物进出口额数据来自 FAOSTAT 数据库，界定为 Oilseeds；2018 年油料作物进出口额数据来自 UN Comtrade 数据库，界定为 HS1201 ～ HS1207；1995—2017 年畜产品进出口额数据来自 FAOSTAT 数据库，界定为 Pigmeat、Bovine Meat、Meat, goat、Meat, sheep、Milk Equivalent、Butter、Cheese and Curd 和 Wool, degreased；2018 年畜产品进出口额数据来自 UN Comtrade 数据库，界定为 HS0201 ～ HS0204、HS0401 ～ HS0406 和 HS5101；1995—2017 年禽类产品进出口额数据来自 FAOSTAT 数据库，界定为 Poultry Meat 和 Eggs in The Shell；2018 年禽类产品进出口额数据来自 UN Comtrade 数据库，界定为 HS0207、HS0407 和 HS0408；农产品出口额数据来自 WTO 数据库，根据 WTO 贸易统计口径，农产品不包括水产品及其制品。

农产品。但是中国谷物产业的竞争力目标是守住“口粮绝对安全，谷物基本自给”的产业安全底线，并不是促进出口、参与国际竞争。2019 年，稻谷、小麦和玉米三大谷物的自给率达到 98.75%，为经济社会稳定发展和抵御突发事件冲击提供了坚实保障，也是中国谷物产业竞争力的现实反映。

园艺作物和禽类产品等农产品的竞争力目标是积极主动参与国际竞争。园艺作物和禽类产品等农产品具备较强的市场化属性，也具备较强的国际贸易比较优势。从显示性比较优势指数来看，2018 年中国园艺作物的显示性比较优势指数达到 1.94，是中国最具国际贸易比较优势的农产品类别。这类农产品的竞争力目标是进一步提升比较优势和产业竞争力，积极主动参与国际竞争。

从成本竞争力来看，中国主要农产品生产成本快速增加，人工成本和土地成本是推高农产品生产成本的最主要原因。1992—2018 年，剔除物价上涨因素，中国小麦每亩人工成本实际增长了 1.7 倍，每亩土地成本实际增长了 6.2 倍。其中，2005—2018 年，中国小麦每亩人工成本实际增长了 1.06 倍，每亩土地成本实际增长了 1.91 倍。2018 年，水稻、小麦和玉米的人工和土地成本占总成本的比重分别达到 57.94%、63.27%、55.55%。但是生产过程中的人工成本和土地成本均转换为农民收入，生产过程中的人工成本也反映出农业作为就业“蓄水池”的重要作用。牺牲部分产业竞争力换取农民增收和社会稳定，在经济增速放缓、制造业由劳动力密集型向技术密集型转变的转型期，具有重要的社会效益。

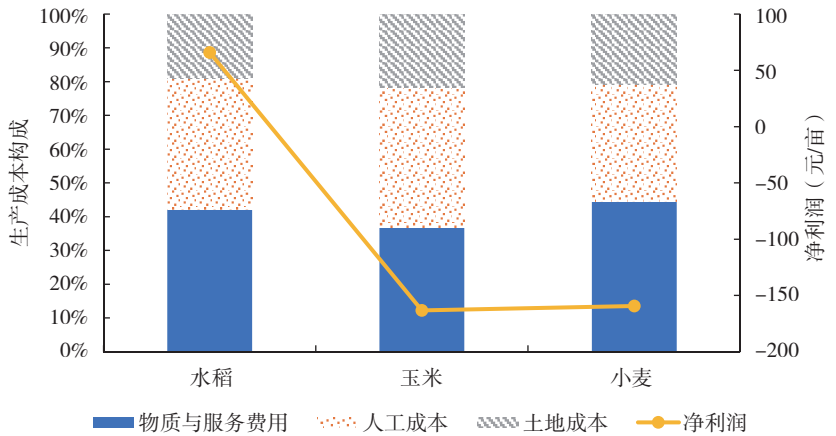

图 2　2018 年中国三大谷物生产成本构成与净利润

资料来源：2019 年《中国农村统计年鉴》。

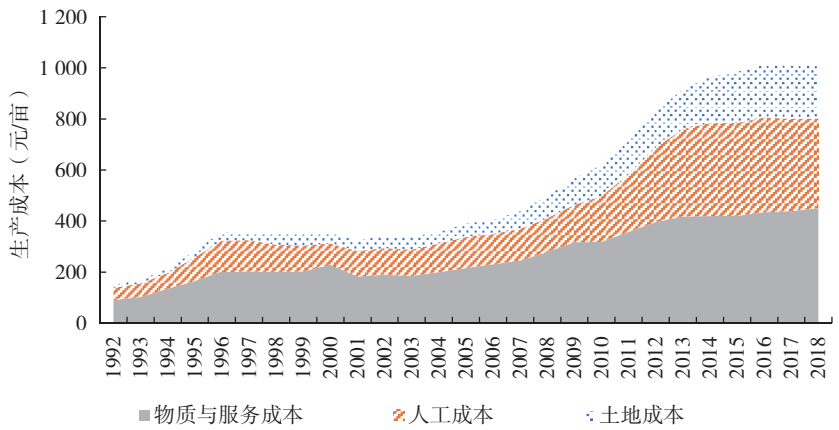

图 3　1992—2018 年中国小麦生产成本变动趋势

资料来源：历年《中国农村统计年鉴》。

从全要素生产率来看，改革开放以来，技术进步是中国农业全要素生产率提升的主要驱动力。1978—2018 年，中国农业全要素生产率指数（TFPI）增长 2.61 倍，年均增长 3.26%。其中，体现技术进步的技术变化指数（ETI）增长 2.03 倍，年均增长 2.81%，对农业全要素生产率指数增长的贡献约为 78%；体现效率提升的技术、规模和混合效率指数（TSMEI）增长 18.88%，年均增长 0.43%。

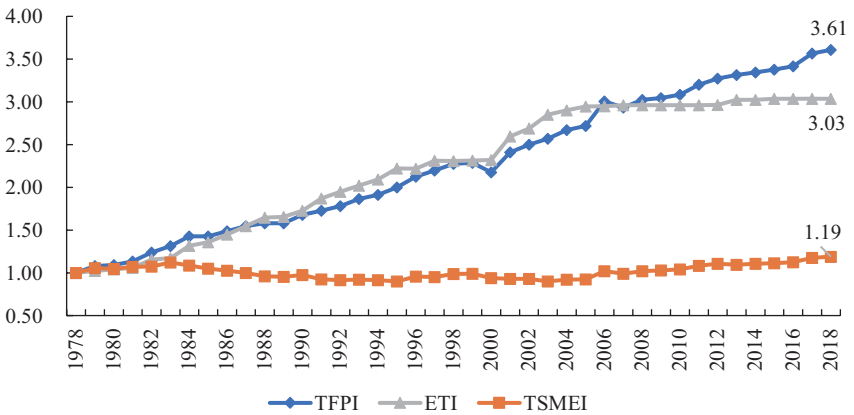

图 4　中国农业 TFP 指数（TFPI）的分解（1978 年 =1）

资料来源：根据全国省级农业统计数据计算得到。

2005 年以来农业科技进步面临瓶颈，效率提升成为农业 TFP 的主要增长来

源。以 2005 年为界，1978—2005 年中国农业全要素生产率指数（TFPI）增长 1.72 倍，年均增长率为 3.77%。其中，技术变化指数（ETI）增长 1.95 倍，年均增长 4.08%，对农业全要素生产率指数增长的贡献超过 100%；技术、规模和混合效率指数（TSMEI）下降 7.71%，年均降幅为 0.30%。2005—2018 年，中国农业全要素生产率指数（TFPI）增长 32.72%，年均增长率为 2.20%。其中，技术变化指数（ETI）增长 3.03%，年均增长 0.23%，对农业全要素生产率指数增长的贡献仅为 10.45%；技术、规模和混合效率指数（TSMEI）增长 28.82%，年均增幅为 1.97%。

与此同时，2005 年以来中国农业生产成本开始迅速上升，主要农产品的贸易比较优势逐渐丧失，农产品贸易逆差不断扩大。根据商务部统计数据，中国农产品贸易逆差从 2005 年的 14.6 亿美元增至 2018 年的 712.8 亿美元。农业科技进步未能驱动农业 TFP 实现有效增长是中国农业竞争力总体下滑的重要原因之一，农业科技投入相对不足是农业科技进步未能突破瓶颈的重要因素。2016 年，中国农业科技经费投入占第一产业 GDP 的比重在 0.76%，明显低于全国总科技经费投入占 GDP 的比重 2.12%。

因此，有必要坚持农业科技优先发展，深化农业科技体制改革，在基础性、

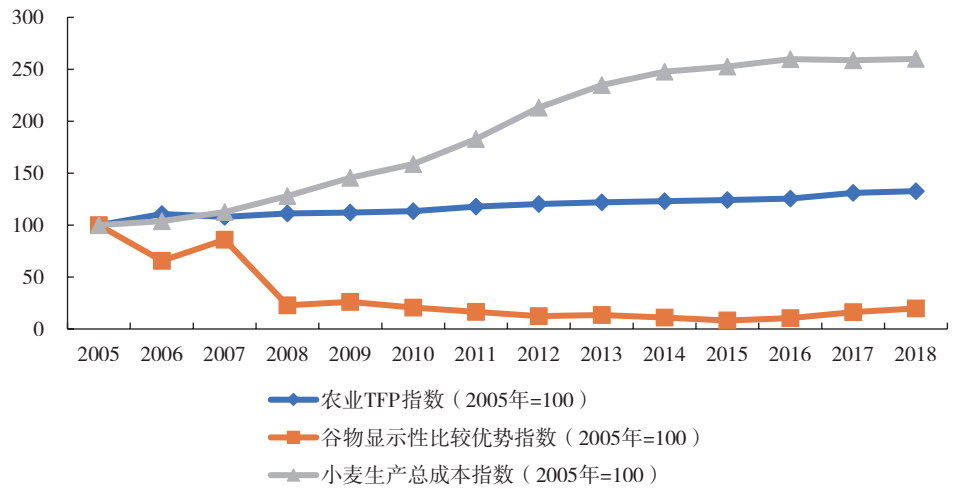

图 5　2005—2018 年中国农业 TFP 指数、农产品显示性比较优势与小麦生产总成本变动趋势

资料来源：笔者计算。

公益性科研领域建立稳定可持续的财政投入机制，以问题为导向开展一体化农业科技创新，推出农业科技综合解决方案。

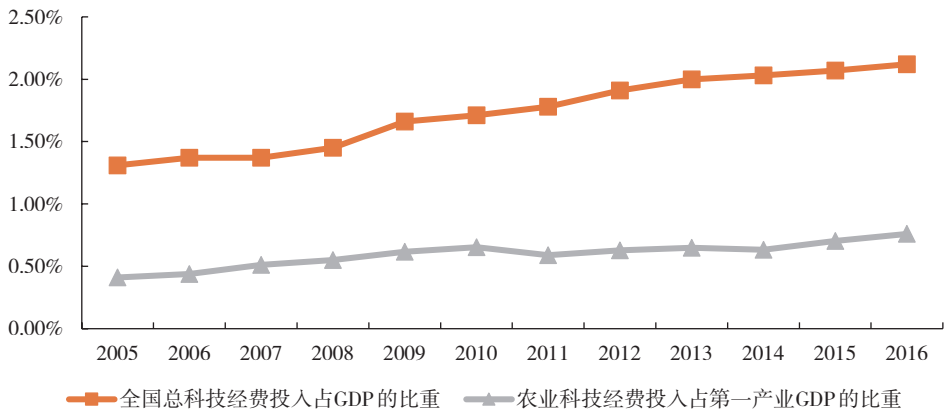

图 6　2005—2016 年中国农业科技经费投入强度

注：农业科技经费投入指全国农业研发机构和涉农高校科技经费投入总额。
资料来源：历年《中国科技统计年鉴》和《中国统计年鉴》。

三、产业热点问题关注

（一）新冠肺炎疫情对农业—食物系统和农民收入的影响

新冠肺炎疫情对中国经济产生了重大冲击。国家统计局的数据显示，2020 年第一季度，全国 GDP 同比下降 6.8%，湖北省的 GDP 同比下降 39.2%；全国第一产业增加值同比下降 3.2%，湖北省的第一产业增加值下降 24.8%。新冠肺炎疫情对劳动力就业和居民收入也产生明显冲击。2 月底，外出务工农村劳动力减少 30%，月均收入下降 7.9%。2 月和 3 月城镇劳动力失业率分别提高到 6.2% 和 5.9%。扣除价格因素，第一季度，全部居民的人均收入同比下降 3.9%，城镇和农村居民的人均收入分别下降 3.9% 和 4.7%。在国内疫情基本控制后，疫情对中国的宏观经济、农业及相关产业的影响都明显减弱。然而，随着新冠肺炎疫情蔓延到全球，对世界经济和贸易产生冲击。据国际货币基金组织 4 月的预测，2020 年全球经济增长为 –3%，疫情的影响超过了 2008 年国际金融危机的影响。

本研究从产业链视角，运用构建的2017年149个部门的中国社会核算矩阵（SAM表），采用SAM乘数分析法从产业链视角全面模拟评估疫情对农业及其相关产业和农民收入的潜在影响。该方法能够全面反映农业和其他国民经济行业间的所有直接和间接联系，同时，能够分析对居民收入分配的影响。

根据疫情发展和管控措施，设计了高峰期、恢复期和正常时期三种模拟方案。模拟方案假设：高峰期为1月23日（武汉封城）到在3月的第一周，共5周；假设恢复期为3月第二周到9月底；第四季度恢复正常。为了能够反映国际出口不确定性对中国经济的影响，进一步将正常时期分为外贸需求未恢复和完全恢复两种情景，分别称为正常期1和正常期2。最后，将三个阶段的经济影响进行汇总，以持续的时间长短为权重，估算国民经济在全年受到的影响。

模型结果表明，新冠肺炎疫情对国民经济、农业和农业食物系统的冲击显著。在高峰期：与无疫情基期相比，全国GDP下降约25%，工业受创最大，下降近三成，服务业下降24%，农业下降的幅度相对小一些，为16%。在农林牧渔部门中，畜牧业和林业受到的影响相对较大一些，渔业和农林牧渔服务业其次，种植业最小。畜牧业和林业GDP均下降20%左右，种植业、渔业和农林牧渔服务业下降16%～18%。在农业相关产业中，餐饮和住宿业、纺织业受到的冲击最大，GDP下降超过四成，食品工业GDP下降27%，中间投入品化学制品行业、批发和零售行业GDP分别下降20%左右。由于政府的严格防疫措施取得了显著效果，疫情得到较快的控制，这些负面影响持续的时间较为短暂。在国内的疫情基本控制后，疫情对中国的宏观经济和农业—食物系统的影响都显著减弱，然而，随着新冠肺炎疫情蔓延到全球，疫情对中国的影响将变得更加持久，尤其是受到出口下降的影响，经济和就业都难以短时间内恢复到正常水平。从全年平均来看，高峰期如果第四季度出口不能恢复，2020年GDP的年增长率将仅为1.2%，但如果第四季度出口能够完全恢复，GDP年增长率将达到1.9%。2020年，农业和农业—食物系统的GDP增长率可能仅分别为0.5%～1.4%和0.3%～1.1%，低于正常情况下3%和4%左右的增长率。

高峰期劳动力就业受到较大冲击，全部行业的劳动力减少约20%，相当于1.6亿劳动力耽误了5个星期的工作。在恢复期，随着复工复产的步伐加快，农民工逐渐回到城市，疫情对劳动力的冲击明显减弱，全部行业的劳动力就业仍比

基期低 3.5%，约 2700 万人的就业受到影响。在正常时期，只有当国内经济和出口贸易均完全恢复正常后劳动力就业才能恢复正常，但如果全球经济形势仍未能好转，外贸订单减少，出口企业对劳动力需求下降，将导致 697 万劳动力失业。农业—食物系统的劳动力就业在高峰期下降 19.3%，在恢复期下降 4.8%，在正常时期就业接近正常，但如果出口贸易在第四季度仍无法恢复，比无疫情基期低 1.3%，除农业外，约 48 万劳动力受到影响。

相对无疫情的基期，农村居民和城镇居民的年人均收入都下降 5% 左右，2020 年城乡居民收入同比增幅可能仅为 1% 左右。但值得注意的是，从事疫情冲击较大的餐饮和住宿、纺织业等行业的劳动力和家庭受到的冲击将更加显著。

习近平总书记在对全国春季农业生产工作作出重要指示强调，“越是面对风险挑战，越要稳住农业，越要确保粮食和重要副食品安全”。在疫情面前，必须把“三农”工作摆到更加重要的位置。当前和未来一段时期，要统筹抓好决胜全面建成小康社会、决战脱贫攻坚的重点任务，把农业基础打得更牢，把“三农”领域短板补得更实，为打赢疫情防控阻击战、实现全年经济社会发展目标任务提供有力支撑。

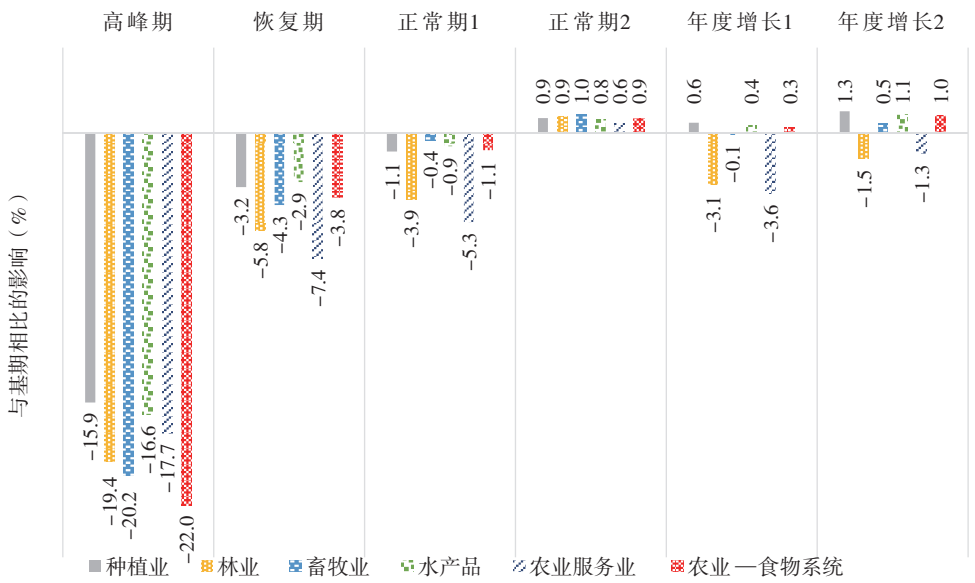

图 7　新冠肺炎疫情对农业—食物系统 GDP 的影响

资料来源：基于 2017 年 149 个部门中国社会核算矩阵的乘数分析模拟结果。

研究发现，作为基础产业，农业具有显著的乘数效应，农业 GDP 增加 1 单位，全部行业 GDP 增加约 3.4 个单位。在国内新冠肺炎疫情基本控制的后期，中国经济恢复仍面临全球新冠肺炎疫情带来的冲击，经济增长面临严峻挑战。相对来说，农业—食物系统对国际市场的依赖程度相对其他行业较小，出口占总产出的比重和进口占总需求的比重都小于 5%，且容纳了近 1/3 的劳动力。在疫

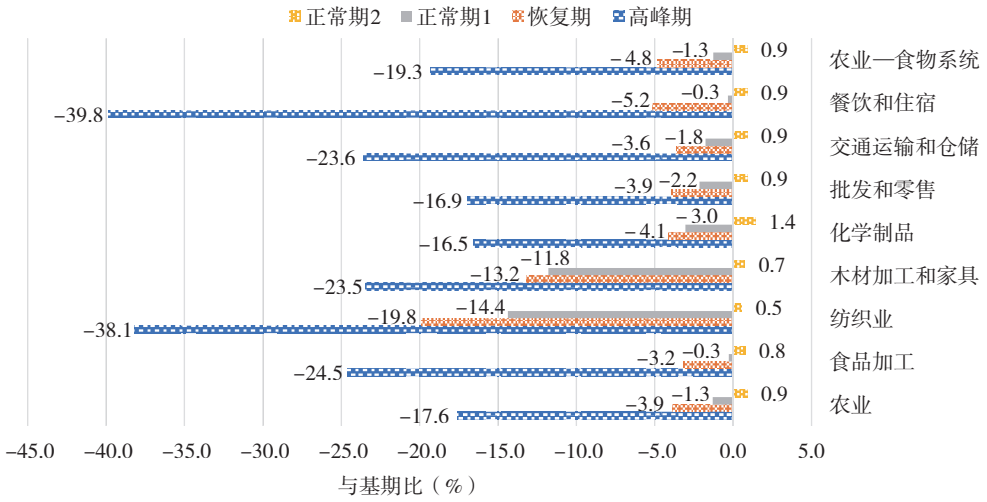

图 8　新冠肺炎疫情对农业及相关行业劳动力就业的影响

资料来源：基于 2017 年 149 个部门中国社会核算矩阵的乘数分析模拟结果。

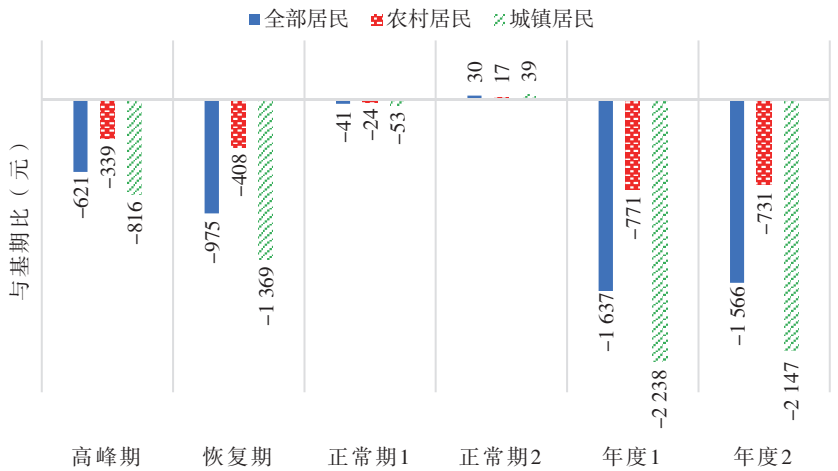

图 9　新冠肺炎疫情对城乡居民人均收入的影响

资料来源：基于 2017 年 149 个部门中国社会核算矩阵的乘数分析模拟结果。

情特殊时期，促进农业和农业—食物系统的发展，有利于经济恢复和拉动就业，促进整个宏观经济增长。

（二）生猪产能恢复趋势判断及其主要影响因素

受到非洲猪瘟等因素影响，2019 年全国生猪产能大幅下滑。2019 年末全国生猪存栏 31 041 万头，同比下降 27.5%；全年生猪出栏 54 419 万头，同比下降 21.6%；猪肉产量 4 255 万吨，同比下降 21.3%。2019 年，猪肉进口量 210.8 万吨，同比增长 75%。2020 年，非洲猪瘟疫情在全国的扩散正在逐步放缓，对生猪养殖业的影响将逐步趋弱。

在不考虑新冠肺炎疫情等外部冲击的情况下，预计生猪产能到 2020 年底可基本恢复至常年水平的 80% 以上，2022 年基本恢复到 2017 年正常水平。中国农业产业模型的模拟结果表明，受到新冠肺炎疫情影响，估计 2020 年猪肉产量比无疫情情景下降 2 个百分点，进口将增至 291.5 万吨。另外，由于生猪生产周期受到影响，如果不采取措施，疫情还会持续影响 2021 年和 2022 年的猪肉产量，比无疫情情景下降 2% 左右，导致猪肉供需缺口扩大，加剧供需紧张局面。猪肉进口关税下调政策将有利于增加进口，猪肉进口总量比基准方案增长 40.6%，一定程度上可以缓解非洲猪瘟疫情对猪肉供给的影响。综合考虑新冠肺炎疫情和猪肉进口关税下降影响，猪肉产量将比基准方案下降 1.9%，进口量增

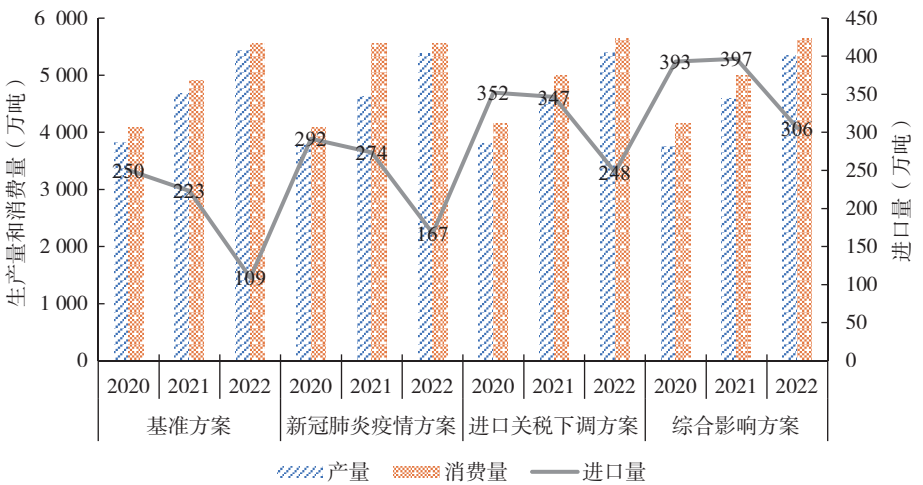

图 10　新冠肺炎疫情和猪肉进口关税下降对猪肉市场的影响

资料来源：中国农业产业模型（CASM）。

长 57.0%，接近 400 万吨。中国猪肉进口增加的来源来看，主要来自欧盟和加拿大，占中国进口总量的 50% 以上。另外，从美国进口的猪肉量也明显增加，尤其在中美贸易协定达成和取消猪肉加征关税的情景，从美国进口猪肉增幅比较显著。建议坚持“两疫”防控和生猪稳产保供两手抓，派出督导组督导检查各地尤其是县、乡等基层政府落实国家相关政策情况，支持和推进相关企业复工复产并加强监督管理，加强技术指导提高能繁母猪繁殖效率。

（三）草地贪夜蛾对 2020 年中国玉米产业的影响

草地贪夜蛾是起源于美洲热带和亚热带地区的多食性害虫，2016 年从非洲开始，迅速在撒哈拉以南的 44 个国家蔓延。2019 年 1 月 11 日草地贪夜蛾在中国云南首发后，呈由南到北、由西到东的扩散特点。截至 10 月 8 日，草地贪夜蛾已侵入中国西南、华南、江南、长江中下游、黄淮、西北、华北地区的 26 省 1 518 个县，玉米发生面积为 1 598.13 万亩，其他作物发生面积为 22.63 万亩。2020 年境内外虫源的双重叠加，一定程度上加重了中国草地贪夜蛾的发生程度。农业农村部在 2020 年 2 月发布的《2020 年全国草地贪夜蛾防控预案》中，预计 2020 年发生面积在 1 亿亩左右，且虫情呈“越冬量更大、北迁时间更早、发生区域更广、为害程度更重”特点，2020 年中国草地贪夜蛾重发态势明显、形势严峻。

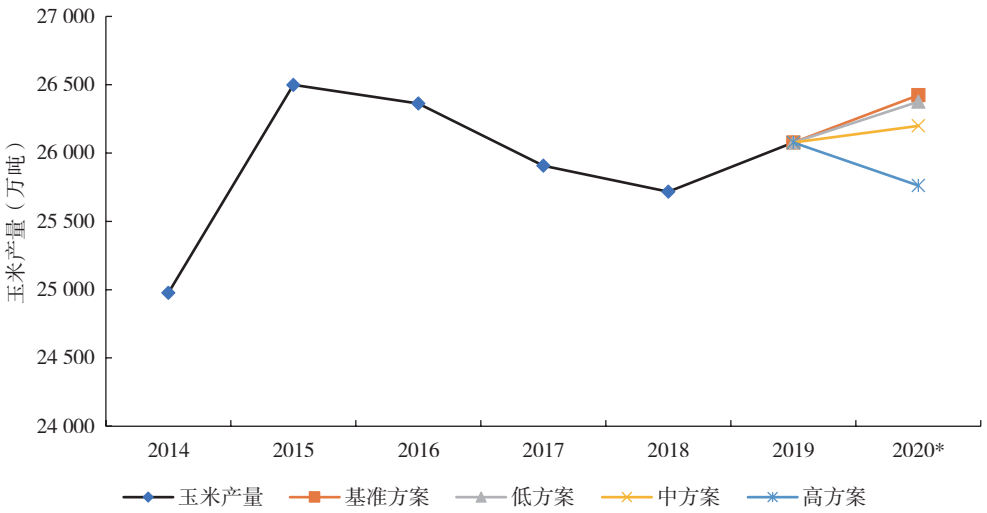

图 11　草地贪夜蛾对 2020 年玉米产量的影响

资料来源：中国农业产业模型（CASM）。

2020 年中国玉米产业可能面临草地贪夜蛾导致的减产风险。研究发现，全国玉米单产损失可能小于 2.5%，供需潜在缺口增至 353 万～ 966 万吨的区间。草地贪夜蛾导致的玉米供需缺口将通过释放库存、玉米进口以及替代品进口等多种途径进行弥补。建议建立并完善草地贪夜蛾防控工作机制，将为害损失降到最低；建立草地贪夜蛾虫害预警监测信息发布体系，实现信息共享；稳定主产区玉米播种面积，保障国内玉米安全供给。

结　语

2020 年是全面建成小康社会和“十三五”规划收官之年，也是脱贫攻坚决战决胜之年。面对国内外风险与挑战，必须稳住农业，确保粮食和重要副食品安全。2019 年中国粮食产量达到 6.6 亿吨，中国农业产业模型（CASM）模拟结果显示，预计 2020 年全国粮食产量达到 6.7 亿吨，能够为打赢疫情防控阻击战、实现全年经济社会发展目标任务提供有力支撑。

习近平总书记强调，面对严峻复杂的国际疫情和世界经济形势，我们要坚持底线思维，做好较长时间应对外部环境变化的思想准备和工作准备。全球农业已经进入风险释放和风险管控阶段，长期来看，中国农业产业发展面临的外部风险包括全球气候变化、国际贸易摩擦、外来物种入侵、动植物疫病等。必须坚持推动农业科技持续进步，提升农业产业竞争力，实现农业平稳健康发展，有效实现风险防控。

CHINA AGRICULTURAL SECTOR DEVELOPMENT REPORT 2020

Editorial board

China Agricultural Sector Development Report 2020 (Summary)

In the year 2020, building a moderately prosperous society in all respects will be achieved and the 13th Five-Year Plan will conclude; the battle against poverty will also be decisively won. Both at domestic and abroad, the economic and social situations have experienced significant changes due to the COVID-19 pandemic. President Xi Jinping emphasized the necessity of planning and advancing efforts regarding epidemic prevention and economic and social development by focusing on key tasks toward the comprehensive construction of finishing building a moderately prosperous society in all respects and defeating poverty. Against this backdrop, Strengthening the strategic status of the "SANNONG" (agriculture, rural community, and farmers) issues provides a solid foundation for achieving a "double victory" in the efforts aimed at preventing and controlling epidemics and advancing economic and social development to ensure the establishment of building a moderately prosperous society in all respects as planned.

China Agricultural Sector Development Report 2019 mentioned that the agri-food system is a "ballast stone" for the revitalization of rural industries. Meanwhile, the sufficient agriculture labor force is essential for job security. In addition, the strategic status of agriculture held firmly to promote national economic development. As one of the important features of China's agricultural policy, competing for farmers' income is also included in the report. On the other hand, African swine fever will lead to a decline in pork consumption and feed demand.

In 2020, the *China Agricultural Sector Development Report 2020* continues to highlight the features it possesses that are oriented toward strategy and grounded in

quantitative analysis. Based on statistical data and cutting-edge research methods, such as China's Agricultural Sector Model (CASM), this report has reviewed and forecasted trends in domestic and international macro economies and agricultural industries from the perspective of the agri-food system; compiled and organized major events closely related to agricultural development in 2019; dissected the competitiveness of China's agricultural industry from the three perspectives of total factor productivity (TFP), international trade, and production costs; analyzed the impact of the COVID-19 pandemic on Chinese agriculture and farmers' income; evaluated the trend of recovery in hog production capacity and the main factors influencing this trend; simulated the impact of the fall armyworm (*Spodoptera frugiperda*) on China's corn industry in 2020; summarized the industrial development characteristics of 18 important agricultural products of cereals, oilseeds, livestock products and aquatic products in 2019; and provided the prospective development trends of related industries from 2020 to 2021.

I. Review of Agricultural Industry Development in 2019

Reflecting on 2019, the global economic growth has fallen rapidly to the lowest level since the 2008 financial crisis due to the cumulative effects of major uncertainties, such as trade frictions, geopolitical tensions, and recession risk, thereby resulting in a slowdown in the global agricultural production. China's national economy has generally been stable, and the quality of development has steadily improved. Significant goals have been realized, agricultural development is steadily progressing and improving, as grain production has stood at 1.3 trillion catties for five consecutive years while that of cotton, oil, and sugar has remained stable. Further, a sufficient supply of fruits, vegetables, and tea has been maintained while hog production has rebounded.

Given the continuous advancement of efforts to adjust the planting structure for cereals. In 2019, rice planting area and yield continue to decline; the planting

area of wheat and corn declined, however, the yield and total output increased. The output of rice, wheat and corn reached 210 million tons, 134 million tons and 257 million tons, respectively. The total consumption of the three major cereals reached 612 million tons, an increase of 0.41% from 2018. Among them, rice consumption increased steadily and slightly, wheat consumption increased slightly, and corn demand slowed down overall. In term of trade, rice exports have surpassed imports for the first time in nine years, while wheat and corn imports are on the rise.

The soybean revitalization plan has witnessed a good start, as soybean production continues to rebound with output reaching 18.1 million tons, a year-on-year increase of 13.5%. Rapeseed planting area and output continue to decline, peanut output continues to increase. Due to the African swine fever epidemic, soybean feed consumption decreased by 11.47% year-on-year. Imports of soybeans and rapeseed increased, while the net exports of peanuts slowed down. Among them, soybean imports reached 88.511 million tons, an increase of 0.5% year-on-year.

The output of other crops basically remained stable, and the output of cotton declined. The potato output is maintained at over 100 million tons, and the total export volume exceeds 500,000 tons; Affected by unfavorable factors, such as natural disasters, the cotton yield has fallen by 3.1% year-on-year. The total output decreased by 3.5%, and net imports reached 1.798 million tons, an increase of 16.2% year-on-year, while the percentage of U.S. cotton imports has declined significantly; meanwhile, Brazil has become China's largest source of cotton imports. Sugar, vegetable, and fruit production has grown steadily, and vegetable imports and exports are demonstrating an upward trend. The export volume of fresh or frozen vegetables increased by 3.5% year-on-year, and the export value denominated in RMB increased by 24.9% year-on-year. The net imports of fresh and dried fruits and nuts increased from 2.24 million tons in 2018 to 3.48 million tons in 2019, and the trade deficit in RMB terms increased by 63.4% year-on-year.

Pork production fell sharply, chicken production increased significantly. As the African swine flu epidemic continues, the 2019 hog inventory declined by 27.50%

year-on-year, while pork output was 42.55 million tons, a decline of 21.26% year-on-year. However, the hog inventory began rising month-on-month in the latter half of the year. Beef output increased by 3.56% year-on-year. The cattle supply continues to remain tight, while the prices of calves have continued increasing. Interest in meat sheep breeding is high, as its scale of production continues to enlarge. Meat chicken production has increased significantly, with white - and yellow-feathered chicken production rising by 11.40% year-on-year, which is a historical high. Egg production has also increased significantly, and the output increased by 5.78% year-on-year, while egg and spent hen prices have fluctuated at high levels. The production structure of the dairy industry is gradually optimized, and the output of milk keeps increasing. Seafood production has remained stable, and full coverage has been achieved in the seven major river basins during the fishing ban period. Domestic fishing volume has dropped significantly, and the breeding-to-fishing ratio of the national aquatic product has reached 78:22.

II. Competitiveness of the Agricultural Industry

It's necessary to formulate agricultural industry competitiveness targets by varieties according to national conditions and view China's agricultural industry competitiveness from a broader perspective. According to the traditional view, a product with a comparative advantage in international competition can be considered competitive. Based on this view, China's cereals, oil crops and livestock products (excluding poultry products) in 2018 have a Revealed Comparative Advantage Index (RCA) of less than 0.8, that is, they do not have a comparative advantage in international trade, while horticultural crops and poultry products have a comparative export advantage. However, some agricultural products have strong and special in terms of foundation, public welfare, and social nature, and it is oversimplified to judge competitiveness by economic indicators such as explicit comparative advantage.

Keeping the strategic bottom line of "basic self-sufficiency of cereal grains and absolute food security" is the most fundamental competitiveness goal of China's grain industry. Grain is an important agricultural product related to national economy and people's livelihood, and it is also an agricultural product with weak comparative advantage in international trade. However, the competitiveness goal of China's cereal industry is to maintain the industrial safety bottom line of "absolute food rations security and basic grain self-sufficiency", rather than promoting exports and participating in international competition. In 2019, the self-sufficiency rate of the three major grains of rice, wheat and corn reached 98.75%, which provided a solid guarantee for the stable development of the economy and society, as well as resistance to the impact of emergencies. And that was a realistic reflection of the competitiveness of China's cereal industry.

The competitiveness goal of agricultural products such as horticultural crops and poultry products is to actively participate in international trade competition. Agricultural products such as horticultural crops and poultry products of China have strong market-oriented attributes and strong comparative advantages in international trade. From the perspective of the displayed comparative advantage index, the RCA of China's horticultural crops reached 1.94 in 2018, which is China's agricultural product category with the most comparative advantage in international trade. The competitiveness goal of such agricultural products is to further enhance comparative advantage and industrial competitiveness, and actively participate in international competition.

From cost competitiveness point of view, the production costs of major agricultural products in China are rising rapidly. From 1992 to 2018, excluding the factors of rising prices, China's labor cost of wheat production per mu increased by 1.7 times in real price, and the land cost per mu increased by 6.2 times in real price. Labor and land costs constitute the main reasons for the increase in production costs for agricultural commodities. In 2018, the labor and land costs for rice, wheat, and corn accounted for 57.94%, 63.27%, and 55.55% of their total costs, respectively.

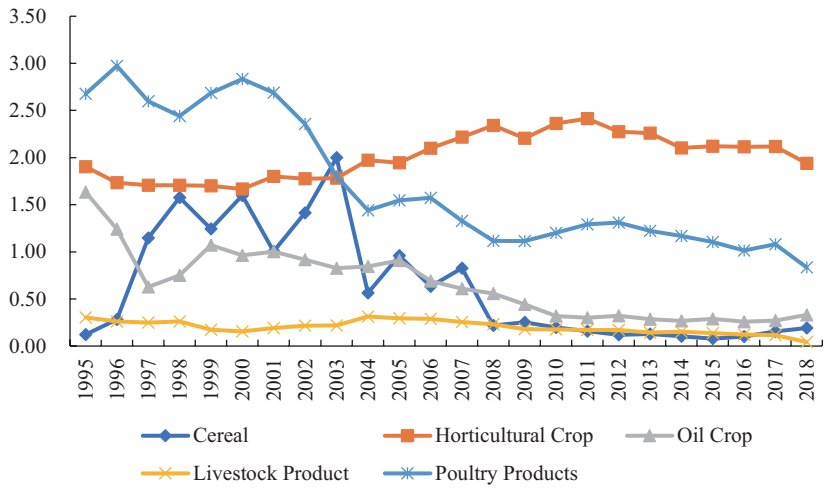

Figure 1 Indicative Comparative Advantage Index of Major Agricultural Products in China during 1995-2018

Note: It is generally believed that an explicit comparative advantage index of less than 0.8 does not have a comparative advantage in exports.

Source: 1995-2017 cereal import and export data from the FAOSTAT database, defined as Cereals; The 2018 cereal import and export data comes from the UN Comtrade database and is defined as HS10; 1995-2017 horticultural crop import and export data comes from the FAOSTAT database, defined as Fruit and Vegetables; The 2018 horticultural crop import and export data comes from the UN Comtrade database and is defined as HS08 and HS0702 ~ HS0712; 1995-2017 oil crop import and export data comes from the FAOSTAT database and is defined as Oilseeds; The 2018 oil crop import and export data comes from the UN Comtrade database and is defined as HS1201 ~ HS1207; the import and export data of livestock products from 1995 to 2017 come from the FAOSTAT database and are defined as Pigmeat, Bovine Meat, Meat, goat, Meat, sheep, Milk Equivalent, Butter, Cheese and Curd and Wool, degreased; The import and export data of animal products in 2018 come from the UN Comtrade database and are defined as HS0201 ~ HS0204, HS0401 ~ HS0406 and HS5101; The import and export data of poultry products from 1995 to 2017 came from the FAOSTAT database, defined as Poultry Meat and Eggs in The Shell; The import and export data of poultry products in 2018 come from the UN Comtrade database and are defined as HS0207, HS0407 and HS0408; The agricultural product export data comes from the WTO database. According to WTO trade statistics, agricultural products do not include aquatic products and their products.

However, the labor and land costs incurred during the production process are converted into farmers' income. The labor cost incurred during the production process also reflects agriculture's important role as a job "reservoir". During the period of slowing economic growth and the transition of the manufacturing industry from labor-intensive to technology-intensive, sacrificing some industrial competitiveness in exchange for increasing farmers' income and social stability has important social benefits.

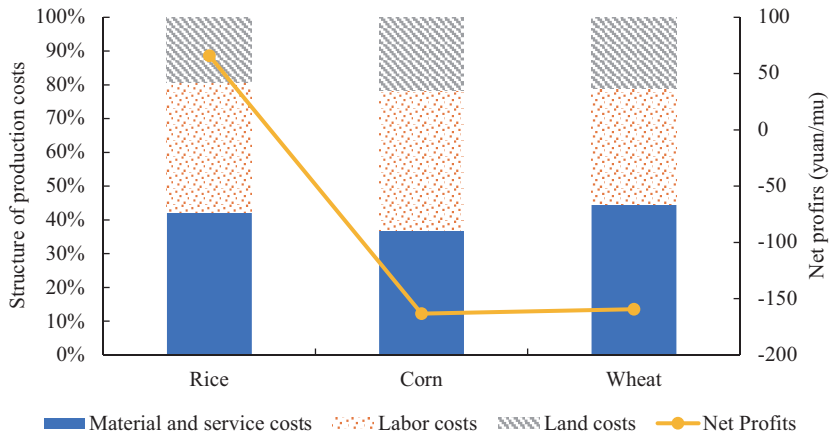

Figure 2 China's three major cereal production costs and net profit in 2018

Source: China Rural Statistical Yearbook 2019.

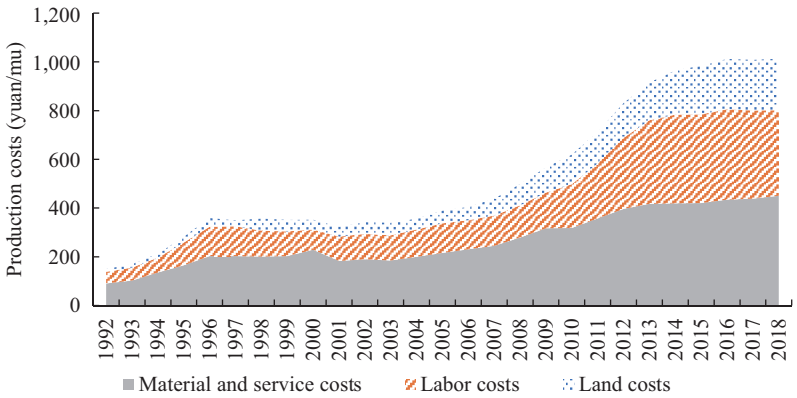

Figure 3 Trends of China's wheat production costs during 1992-2018

Source: China Rural Statistical Yearbook over the years.

From the perspective of total factor productivity (TFP), technological progress has been the main driving force for the improvement of China's agricultural TFP since the reform and opening up. From 1978 to 2018, China's agricultural TFP index (TFPI) increased 2.61 times, with an average annual growth rate of 3.26%. Among them, the environment and technology index (ETI) that reflecting technological progress increased by 2.03 times (the environment variable is constant in this study), with an average annual growth of 2.81%, and contributed about 78% to the growth of

TFPI; The technical, scale and mix efficiency index (TSMEI), which reflects efficiency improvement, increased by 18.88%, with an average annual growth rate of 0.43%.

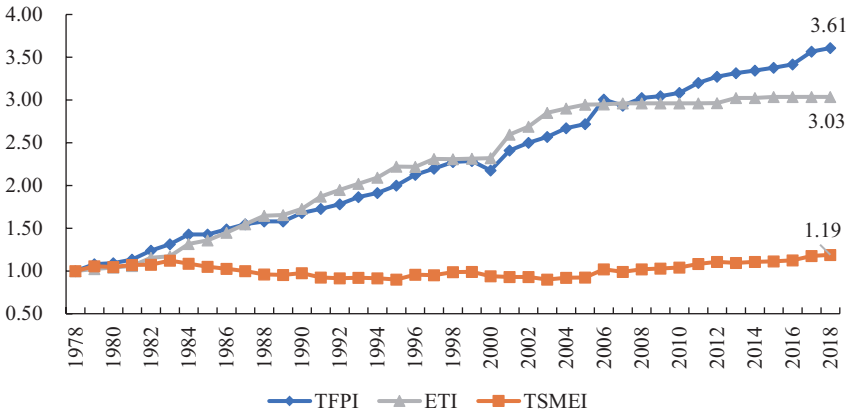

Figure 4 Decomposition of China Agricultural TFP Index (TFPI) (1978 = 1)

Source: Calculated based on national provincial agricultural statistics.

Since 2005, agricultural scientific and technological progress has faced bottlenecks, and efficiency improvement has become the main source of agricultural TFP growth. Taking 2005 as the boundary, China's agricultural TFPI increased by 1.72 times from 1978 to 2005, with an average annual growth rate of 3.77%. Among them, the ETI increased by 1.95 times, with an average annual increase of 4.08%, and contributed more than 100% to the growth of TFPI; the TSMEI decreased by 7.71%, with an average annual decrease of 0.30%. From 2005 to 2018, China's agricultural TFPI increased by 32.72%, with an average annual growth rate of 2.20%. Among them, the ETI increased by 3.03%, and the average annual growth rate was 0.23%. The contribution to the growth of the agricultural TFPI was only 10.45%; the TSMEI increased by 28.82%, with an average annual growth rate of 1.97%.

At the same time, the cost of agricultural production in China has risen rapidly since 2005, the comparative advantages of major agricultural products have gradually been lost, and the agricultural trade deficit has continued to expand. According to statistics from the Ministry of Commerce, China's agricultural

trade deficit increased from U.S. $ 1.46 billion in 2005 to U.S. $ 71.28 billion in 2018. Agricultural scientific and technological progress failed to drive agricultural TFP to achieve effective growth is one of the important reasons for the overall decline in China's agricultural competitiveness. The relative lack of investment is an important factor in the failure of agricultural scientific and technological progress to break through the bottleneck. In 2016, the intensity ratio of China's agricultural science and technology expenditure to agricultural GDP was only 0.76%, which was significantly lower than the intensity ratio of the national science and technology total expenditure to total GDP, 2.12%.

Therefore, it is necessary to prioritize the development of agricultural science and technology, deepen the reform of agricultural science and technology system, establish a stable and sustainable financial investment mechanism for fundamental and public welfare-oriented scientific research, engage in problem-oriented and integrated agricultural science and technology innovation, and launch comprehensive solutions to enable agricultural science and technology.

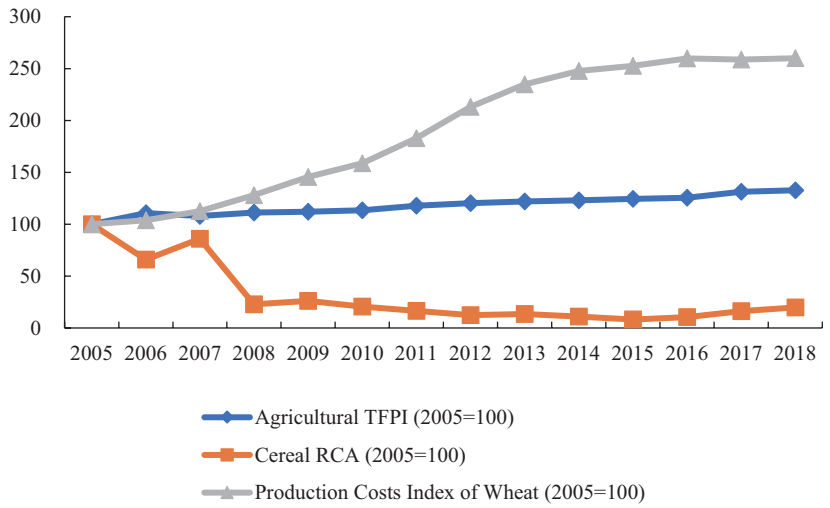

Figure 5 China's agricultural TFPI, the RCA of agricultural products, and the trend of production cost of wheat during 2005-2018

Source: Author's calculation.

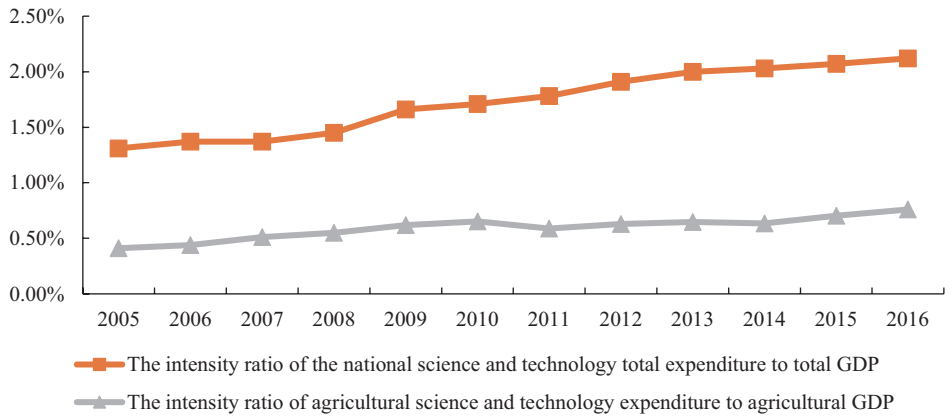

Figure 6 China Agricultural Science and Technology Investment Intensity during 2005-2016

Note: The investment in agricultural science and technology refers to the total investment in science and technology of agricultural research and development institutions and agricultural universities in China.
Source: China Science and Technology Statistical Yearbook and China Statistical Yearbook over the years.

III. Industry Hot Issues

(I) Impact of the COVID-19 Pandemic on the Agri-Food System and Farmers' Income

The COVID-19 pandemic has significantly impacted China's economy. According to data published by the National Bureau of Statistics, China's GDP in the first quarter of 2020 fell by 6.8% year-on-year. Meanwhile, the GDP of Hubei Province decreased by 39.2% year-on-year; the added value of primary industries in China declined by 3.2% year-on-year; while the added value of the primary industry in Hubei Province fell by 24.8%. The COVID-19 pandemic also has a significant impact on labor employment and residents' income. At the end of February, the rural labor force that went out to work decreased by 30%, and the average monthly income fell by 7.9%. The unemployment rate of the urban labor force rose to 6.2% and 5.9% in February and March, respectively. Excluding price factors, in the first quarter, the per capita income of all residents fell by 3.9% year-on-year, and the per capita income of urban and rural residents fell by 3.9% and 4.7%, respectively. The impact of the epidemic situation on China's macroeco-

nomics, agriculture and related industries has significantly weakened after the domestic epidemic situation is basically controlled. However, as the COVID-19 epidemic spread globally, it has an impact on the world economy and trade. According to the forecast of the International Monetary Fund in April, the global economic growth in 2020 is -3%, and the impact of the epidemic has exceeded that of the 2008 financial crisis.

In this study, from the perspective of the industry chain, the According to the epidemic development and control measures, three scenarios were designed for peak period, recovery period and normal period. The scenario assumes that the peak period is from January 23 (Wuhan lockdown) to the first week of March, a total of 5 weeks; The recovery period is from the second week of March to the end of September; Return to normal in the fourth quarter. In order to reflect the impact of the uncertainty of international exports on the Chinese economy, the normal period is further divided into two scenarios of unrecovered export demand and fully recovered export demand, called normal period 1 and normal period 2, respectively. Finally, the economic impact of the three stages is summarized, and the duration is used as the weight to estimate the impact of the national economy throughout the year.

Social Accounting Matrix Multiplier Analysis method was applied to comprehensively simulate and evaluate the potential impact of the epidemic on agriculture and related industries as well as farmers' income using the constructed 2017 China Social Accounting Matrix with 149 sectors. This method can comprehensively reflect all the direct and indirect linkages between agriculture and other national economic sectors, and at the same time, it can analyze the impact on residents' income distribution.

The model results show that the COVID-19 epidemic has a significant impact on the national economy, agriculture, and agri-food systems. During the peak period: Compared with the epidemic-free base period, the national GDP falls by about 25%, the industry suffers the most, with a decline of nearly 30%, the service industry falls by 24%, and the decline in agriculture is relatively small, at 16%. Among the subsectors of agriculture, animal husbandry and forestry are relatively heavily affected, followed by fishery and agricultural services, while planting is the least affected. The GDP of animal

husbandry and forestry both fall by about 20%, and the planting, fishery and agricultural services decline by 16% to 18%. Among the agriculture-related industries, the catering and lodging industry as well as the textile industry will suffer the most. The GDP will fall by more than 40%, the GDP of the food processing industry falls by 27%, and the GDP of the intermediate input chemical industry, wholesale and retail industries falls by about 20%. As the government's strict anti-epidemic measures have achieved significant results, the epidemic situation has been quickly controlled, and these negative effects last for a relatively short period of time. After the domestic epidemic situation is basically controlled, the impact of the epidemic situation on China's macroeconomic and agri-food systems will be significantly weakened. However, as the COVID-19 epidemic spreads globally, the impact of the epidemic on China will become more lasting, especially due to the decline in exports, and it is difficult for the economy and employment to return to normal levels in a short time. From the average of the whole year, if the export in the fourth quarter cannot be recovered during the peak period, the annual growth rate of GDP in 2020 will be only 1.2%, but if the export in the fourth quarter can be fully recovered, the annual growth rate of GDP will reach 1.9%. In 2020, the GDP growth rate of agriculture and agri-food systems may only be 0.5% -1.4% and 0.3% -1.1%, respectively, which is lower than the normal growth rate of 3% and 4%.

The employment labor force in the peak period was greatly affected. The labor force in all industries was reduced by about 20%, which is equivalent to 160 million labor force delayed 5 weeks of work. In the recovery period, as the pace of resumption of production and recovery accelerated, the migrant workers gradually returned to the city, the impact of the epidemic on the labor force was significantly weakened, however, the employment of labor in all industries was still 3.5% lower than the base period, and the employment of about 27 million people was affected. In the normal period, labor employment can return to normal only after the domestic economy and export trade are fully restored to normal. However, if the global economic situation still fails to improve, the decrease in foreign trade orders and the decline in labor demand of exporting companies will cause 6.97 million laborers to lose their jobs. Employment in the agri-food

system falls by 19.3% during the peak period and by 4.8% during the recovery period. Employment during the normal period is close to normal, but if export trade could not be recovered in the fourth quarter, it is 1.3% lower than the base period without epidemic conditions. In additional agricultural labor, about 480,000 labors will be affected.

Compared with the base period of no epidemic, the annual per capita income of rural residents and urban residents drop by about 5%. In 2020, the annual income growth of urban and rural residents may be only about 1%. However, it is worth noting that the impact on the labor force and families engaged in the catering and accommodation, textile and other industries that have been hit hard by the epidemic would be more significant.

"The more risks and challenges we face, the more we need to stabilize agriculture and ensure the safety of grain and major non-staple foods," said President Xi Jinping as he highlighted organizing timely spring farming. It is needed to prioritize "SANNONG" issues and improve weak links in order to provide strong support for winning the war to prevent and control the epidemic. At present and for a period of time in the future, we must coordinate the key tasks of establishing a decisive victory, building a moderately prosperous society in all respects, and fighting poverty alleviation, strengthening the foundation of agriculture, and strengthening the shortcomings in the field of the "SANNONG" and provide powerful support for winning the epidemic prevention and control battle, and achieving the goals of economic and social development throughout the year.

Studies have found that as a basic industry, agriculture has a significant multiplier effect. For every additional unit of agricultural GDP, the total GDP increases by about 3.4 units. In the post period of the domestic COVID-19 pandemic effectively controlled, China's economic recovery is still facing the impact of the global COVID-19 pandemic and economic growth is facing severe challenges. The agri-food system is relatively less dependent on the international market than other industries. Both the ratios of agricultural exports to total output and imports to total demand are less than 5%, and it accommodates nearly 1/3 of the total labor force. In the special period of the epidemic, promoting the development of agriculture and the agri-food system is conducive to economic recovery and employment promotion, and promotes the macroeconomic growth.

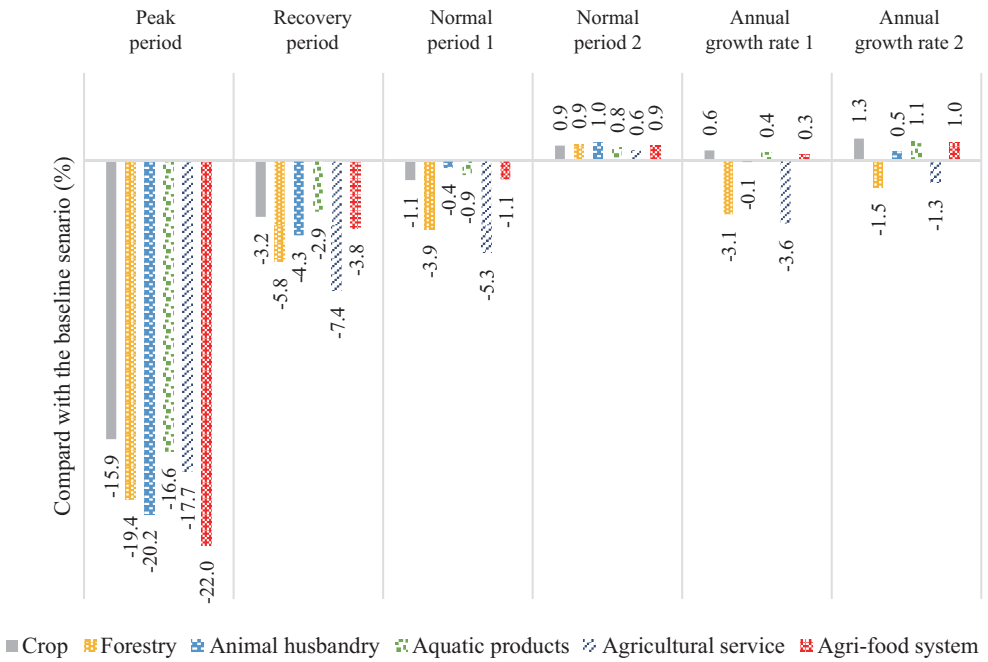

Figure 7 The impact of the COVID-19 epidemic on GDP of Agri-Food System

Source: Simulation results based on the 2017 China Social Accounting Matrix of 149 sectors.

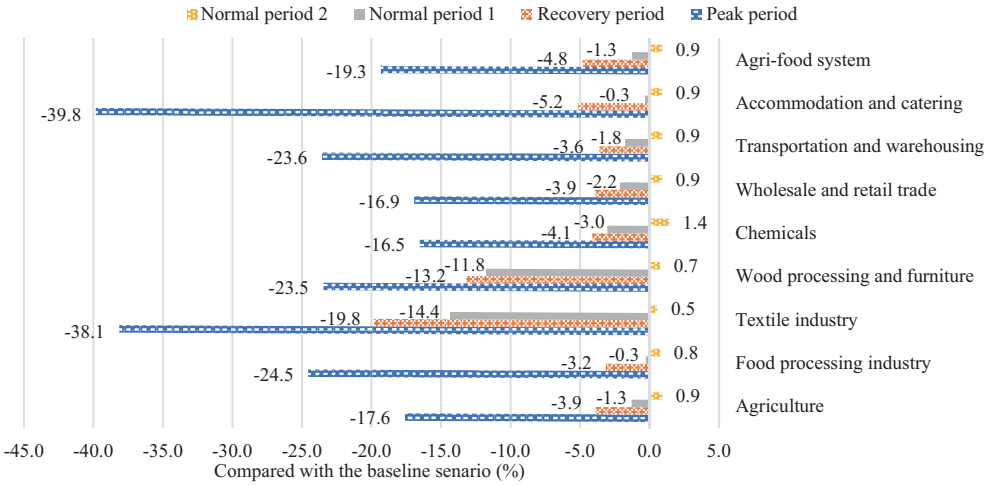

Figure 8 The impact of the COVID-19 epidemic on the employment in agriculture and related industries

Source: Simulation results based on the 2017 China Social Accounting Matrix of 149 sectors

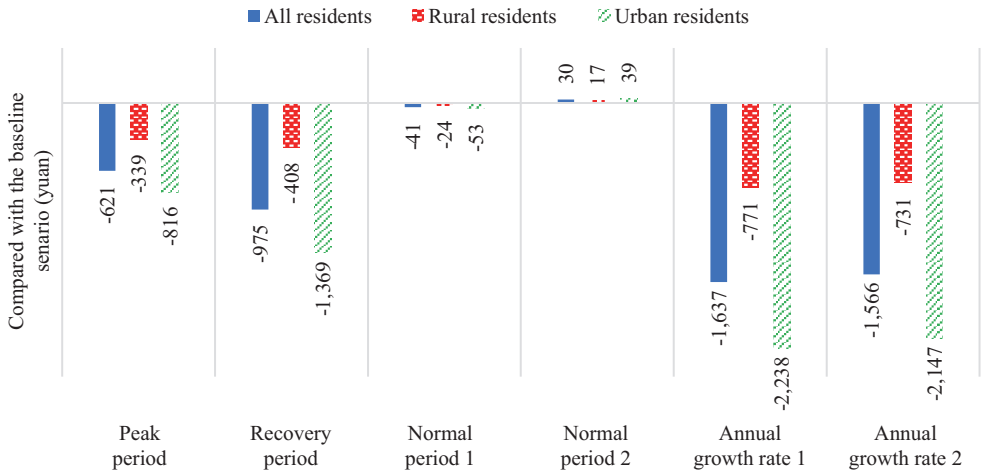

Figure 9 The impact of the COVID-19 epidemic on the per capita income of urban and rural residents

Source: Simulation results based on the 2017 China Social Accounting Matrix of 149 sectors.

(Ⅱ) Recovery Trend in Hog Production Capacity and the Main Influencing Factors

Affected by factors such as African swine fever, the national hog production capacity fell sharply in 2019. At the end of 2019, the number of live pigs in the country was 310.41 million, a year-on-year decrease of 27.5%; the number of live pigs slaughtered was 54.419 million head, a year-on-year decrease of 21.6%; the pork output was 42.55 million tons, a year-on-year decrease of 21.3%. On the other hand, the pork imports reached 2.108 million tons in 2019, a year-on-year increase of 75%. As the African swine fever outbreak in China is gradually slowing down in 2020, its impact on the hog breeding industry will gradually weaken. Regardless of external shocks such as the COVID-19 epidemic, it is expected that hog production capacity will basically return to more than 80% of its normal level by the end of 2020, and will basically return to its normal level in 2017 by 2022.

The simulation results of China's agricultural industry model show that, due to the COVID-19 epidemic, it is estimated that the output of pork in 2020 will be 2

percentage points lower than that of the non-epidemic scenario, and imports will increase to 2.915 million tons. In addition, as the hog production cycle is affected, if no measures are taken, the epidemic situation will continue to affect pork production in 2021 and 2022, which is about 2% lower than that of the non-epidemic scenario. As a result, the gap between pork supply and demand will be widened and the tension between supply and demand will be increased. Pork import will benefit from the tariff reduction policy, the total pork imports will increase by 40.6% compared with the benchmark plan, which can alleviate the impact of African swine fever epidemic on pork supply to a certain extent. Via comprehensively considering the impact of the COVID-19 epidemic and the reduction in pork import tariffs, we expected that pork production will fall by 1.9% from the benchmark, and imports will increase by 57.0% from the benchmark, close to 4 million tons. The sources of increased pork import in China mainly come from the European Union and Canada, accounting for more than 50% of China's total imports. In addition, the volume of pork imported from the United States will also increase significantly, especially in the scenario of the China-U.S.

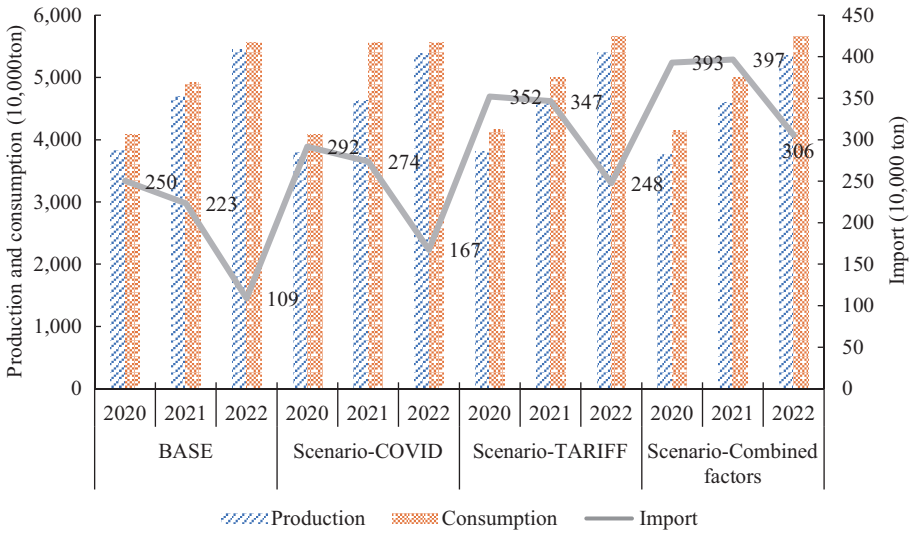

Figure 10 The impact of the COVID-19 Outbreak and Pork Import Tariff Reduction on the Pork Market

Source: China Agricultural Simulation Model (CASM).

trade agreement is reached and the pork tariffs are lifted. The increase in pork imports from the United States would be more significant. It is recommended that China ensure both the prevention and control of "the two epidemics" and also the stable production and supply of hogs by dispatching supervise teams to supervise and inspect the implementation of relevant national policies by local governments, especially counties and townships. supporting and advancing the resumption of operations and productions in related businesses, as well as enhancing its technical guidance to increase the reproductive efficiency of breeding sows.

(Ⅲ) Impact of Fall Armyworm (*Spodoptera frugiperda*) on China's Corn Industry in 2020

The fall armyworm is a polyphagous pest that originated in the tropical and subtropical regions of the Americas. Since 2016, fall armyworms spread from Africa to 44 countries in sub-Saharan Africa. After the pests were first discovered in Yunnan, China on January 11, 2019, they spread from the south to the north and from the west to the east. As of October 8, fall armyworms have invaded 26 provinces and 1,518 counties in Southwest China, South China, Jiangnan, the middle and lower reaches of the Yangtze River, Huanghuai, Northwest China, and North China, and have been found in a total of 15,981.3 thousand mu (1.07 million hm^2) of corn and 226.3 thousand mu (15.09 thousand hm^2) of other crops. Attacks from both domestic and foreign pests in 2020 have aggravated the effects of the fall armyworm invasion in China to an extent. In the "2020 National Fall Armyworm Prevention and Control Plan" issued by the Ministry of Agriculture and Rural Affairs in February 2020, it is anticipated that the total area of pest occurrence in 2020 will be approximately 100 million mu (6.67 million hm^2). Furthermore, the pest situation will be characterized by a "higher number of pests when winter approaches, an earlier northward migration, a wider region of occurrence, and a higher level of danger." The resurgence of fall armyworms in China will be more significant and severe in 2020.

In 2020, China's corn industry may confront an issue of yield reduction due to fall armyworms. Studies have found that China's loss of corn yield may less than

2.5%, while the potential gap between the corn supply and demand will increase to a range of 3.53 to 9.66 million tons. The gap between corn supply and demand due to fall armyworms will be compensated by stock releases, corn imports, and substitute imports. It is recommended to establish and improve the mechanism for the prevention and control of fall armyworms to minimize danger and losses; establish an early warning and monitoring information release system for fall armyworms to realize information sharing; stabilize corn planting area in the main production regions to ensure the safe supply of domestic corn.

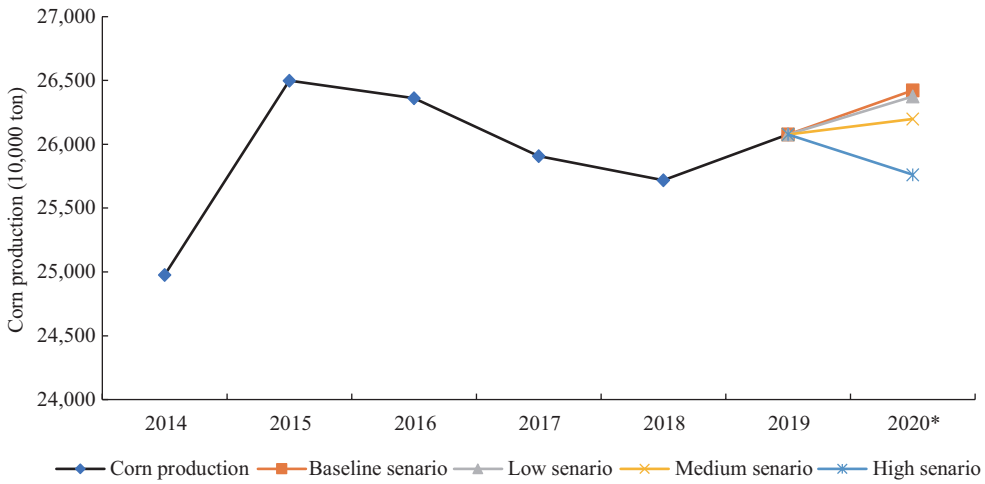

Figure 11 The Impact of Fall Armyworm (*Spodoptera frugiperda*) on China's Corn Production in 2020

Source: China Agricultural Simulation Model (CASM).

Conclusion

In 2020, building a moderately prosperous society in all respects will be achieved and the 13th Five-Year Plan will conclude; poverty will also be defeated. While facing both domestic as well as foreign risks and challenges, we must stabilize agriculture and ensure the safety of grain and non-staple food. In 2019, China's grain output reached

660 million tons, and the CASM simulation results show that the national grain output is expected to reach 670 million tons in 2020, and provide powerful support for winning the epidemic prevention and control battle, and achieving the goals of economic and social development of the year.

President Xi Jinping emphasized that as the pandemic continues its global spread, the world economy faces mounting downside risk. President Xi Jinping also called for preparedness in mind and work to cope with prolonged external environment changes. Global agriculture has entered the stage of risk release and risk management. In the long run, the external risks that the development of China's agricultural industry is facing include global climate change, international trade frictions, invasion of alien species, animal and plant diseases, etc. To ensure the stable and healthy development of agriculture, as well as effectively prevent and control risks, we must insist on promoting the continuous progress of agricultural science and technology and enhance the competitiveness of the agricultural industry.